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Brown's Peony (*Paeonia brownii*)

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Editor: Cindy Roché, PhD

Editorial

I imagine that I'm typical of most NPSO members in that recycling is important to me. I do it as a matter of course in my daily routine. But, there are situations where total recycling is not the best option; for example, volunteers for NPSO tasks. Cycling through the same individuals for holding offices, organizing meetings, publishing newsletters, and writing articles for *Kalmiopsis* year after year can lead to volunteer burnout and stagnation. There have been only a few changes to the *Kalmiopsis* Editorial Board in the last two decades, so I'm pleased to announce that we have added a new board member: Kareen Sturgeon. Kareen is not new to NPSO, but she brings a tremendous amount of fresh energy and skill to *Kalmiopsis*. It also helps that she recently retired and wants to donate her time to our journal. Also exciting is that we have a completely new set of authors this year who have never published in *Kalmiopsis* before. And, they write about subjects from north to south (the Blue Mountains to the Pueblo Valley) and east to west (saltgrass playas to the Coast Range). In this issue, Nan Vance shares her fascination with our lovely wild peony and the native insects that interact with it. Marilyn McEvoy will inspire you to look for rare plants with her search for Pueblo Valley Peppergrass. Caitlin Coberly tells us everything we wanted to know about sex and saltgrass, but were afraid to ask. Finally, I expect that everyone will drop whatever they are doing this summer and head to Marys Peak, the Queen of the Coast Range, after reading about the wildflower bonanza described by Phil Hays, Bob Frenkel, and Esther McEvoy. It's not "out with the old and in with the new," because NPSO couldn't publish *Kalmiopsis* each year without the stalwart volunteers who serve year after year. But, an infusion of new volunteers boosts the energy level for all and bodes well for the future of our Society. *–Cindy Roché, Editor*

Pueblo Valley peppergrass in sand dunes south of Fields, Oregon. Photo by Marilyn McEvoy.

Cover Photo: Brown's Peony (*Paeonia brownii*) on Antelope Mountain, photographed by Norm Jensen on June 25 during the 2011 NPSO Annual Meeting.

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Finding Brown's Peony a Sweet Attraction

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Brown's peony flowering in open prairie near the forest edge. Photo by Nan Vance.

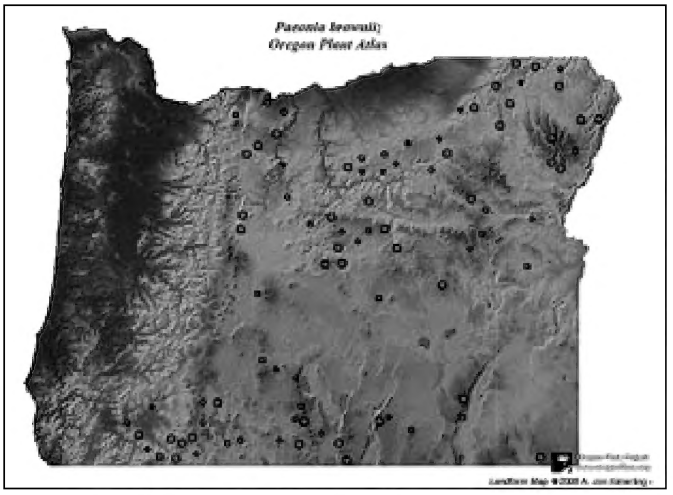
I first encountered Brown's peony (*Paeonia brownii*) with its verdant, lavender-tinged leaves and elegantly nodding maroon flowers growing among bitterbrush and bunchgrass on the eastern flank of the Oregon Cascades. My first thought was "What is a plant like you doing in a place like this?" It would be natural to visualize this native wild peony as a centerpiece in a formal Chinese garden complete with a Koi pond. Perhaps my vision was not that misplaced, considering that most peonies are of Eurasian descent. Asians have venerated the cousins of this peony throughout recorded history for their symbolism, floral beauty, and healing power.

Today the floral beauty of cultivated peonies is universally celebrated in gardens and the arts. Breeders carefully control pollination and propagation to produce a wide variety of floral types. Although our native peony is less showy, it is as hardy and long-lived as its wild relatives of the Eurasian steppe. Many of the Eurasian peony species are threatened in the wild by habitat loss and illegal extraction (Page 2005), but Brown's peony does not seem to be under those same pressures; at least it is not yet the target of a nursery trade. It is surprising how little we know about this species, especially its flowering, pollination and seed production.

Distribution and Habitat

Except for two species, all members of *Paeonia* are Eurasian. California peony (*P. californica*) and Brown's (or western) peony are indigenous to western North America and, like their wild Eurasian relatives, are adapted to habitats with cold winters and warm to hot summers (Page 2005, USDA 1988). Stebbins (1938) suggested Brown's peony was a relict of mesic forests that were once widespread in the northern hemisphere during the Tertiary Period (now Paleocene-Pliocene). He postulated that its populations shrank as the climate warmed, offering as evidence unsuccessful flowering and aborted buds in populations at the southern limit of its range.

The range of Brown's peony spans the interior Northwest, extending from southern British Columbia to the Sierra Nevada in California and east to Wyoming and Utah where it is rare (Hitchcock *et al.* 1964). Its range does not overlap that of California peony, a south-central California endemic that is limited to chaparral and coastal sage scrub in the southern part of the state (Stebbins 1938). In Oregon, the range of Brown's peony extends from the eastern slopes and foothills of the Cascade Range to the Blue Mountains and Owyhee uplands. It extends west of the Cascades only in southern Oregon where it reaches the Siskiyou Mountains.



Distribution of Brown's peony in Oregon. Map courtesy of the Oregon Atlas Project.

Brown's peony thrives in cool, fir-and-aspen communities at middle to high elevations (up to about 8,000 feet), but also persists as scattered individuals in ponderosa pine-dominated forests, open bunchgrass-dominated prairies and dry, sagebrush steppe (USDA 1988). Throughout most of Oregon, Brown's peony is often found in or near seral forest habitats that are prone to frequent wildfire (Agee 1994).

> *... there every man is a physician, wise above human kind; for they are of the race of Paeon. -Homer*
> *Paeonia* is the sole genus in the family Paeoniaceae. The peony is named after Paeon (also Paean) who, according to Greek mythology, was a student of Asclepius, god of medicine and healing. Apollo's mother instructed Paeon to obtain a magical root growing on Mount Olympus to soothe the pain of women in childbirth. When Asclepius became jealous and threatened to kill Paeon, Zeus saved him by turning him into the peony flower.

Description

Brown's peony is a long-lived perennial with branching stems that sprout from buds on its fleshy roots (in the horticultural trade, peony roots are often inappropriately called tubers or bulbs). The often reddish stems bear glabrous, sometimes deeply dissected leaves that are dark green on the upper surface and a lighter, grayish green on the underside. The leaf margins are often purple-tinged, especially in early spring. The solitary bisexual flowers are terminal on the main branches. The greenish-purple bud is globose and the nodding flower is bowl-shaped. The five to six persistent sepals are cupped early on, but later reflex. The five to ten petals are brownish maroon and yellow-tipped at the margins; they senesce and detach when flowering ends. Mounted on the floral axis within each perianth is a ring of dozens of yellow stamens, topped by yellow anthers that open lengthwise. The stamens encircle 2 to 6, glabrous, yellow-red carpels, each having a short style surmounted by a curved stigma. A fleshy disc that encircles the base of the ovaries has greenish-yellow lobes that produce large quantities of nectar. Once the ovules are fertilized, each ovary develops into a several-seeded fruit called a follicle. The seeds are round, yellowish-tan to black, large (a quarter inch or more in diameter), and often fewer than twelve per flower (Hitchcock *et al.* 1964). Peony plants vary in size depending on location and microhabitat; they may appear tall and leggy in the shade or short and spreading in full sunlight. Although long-lived, plants will diminish in size and not flower if conditions are unfavorable but may survive in that state until conditions change (Page 2005).

Observations of Flowering at Three Locations

In the past decade, I have had the good fortune to become better acquainted with Brown's peony through partnering in a study of its flowering and pollination at a site in eastern Oregon and through my own observations at two other locations.

The location of the flowering and pollination study was on the scabland of a shield volcano at about 3,500 ft. elevation within the 6-million-acre Blue Mountains Ecological Province in eastern Oregon. Here, in a mesic-to-xeric bunchgrass prairie adjacent to a coniferous forest, about 300 individuals were scattered in a mixture of grasses, broadleaf herbs, and shrubs. Insect-pollinated species associated with the Brown's peony included redstem ceanothus (*Ceanothus sanguineus*), wild rose (*Rosa nootkana, R. gymnocarpus*), snowberry (*Symphoricarpos albus*), monkshood (*Aconitum columbianum*), balsamroot (*Balsamorhiza sagitatta, B. hookeri*), ragged robin (*Clarkia pulchella*), hairy clematis (*Clematis hirsutissima*), *Delphinium* sp., Wyeth buckwheat (*Eriogonum heracleoides*), desert parsley (*Lomatium dissectum, L. triternatum*), sulphur lupine (*Lupinus sulphureus*), *Penstemon* spp., varileaf phacelia (*Phacelia heterophylla*), cinquefoil (*Potentilla glandulosa, P. gracilis*), sagebrush buttercup (*Ranunculus glaberrimus*), American vetch (*Vicia americana*), and mulesear (*Wyethia amplexicaulus*). The peony colony at this site flowers from mid April through mid May.

Open prairie at the Blue Mountains site in eastern Oregon; Brown's peony in foreground. Photo by Nan Vance.

While conducting a different study, I observed a Brown's peony colony on Green Ridge, a flat-topped ridge at about 3,300 ft., on the eastern flank of the central Oregon Cascade Range that drains northward into the Metolius River. Over 100 widely scattered individuals grew within the perimeter of a wildfire that had burned in 2002. The plant community at this location was a ponderosa pine/bitterbrush/Idaho fescue (*Pinus ponderosa*/*Purshia tridentata*/*Festuca idahoensis*) association. Under the fairly open pine canopy,

numerous shrubs and forbs flowered concurrently with the peony: prostrate ceanothus (*Ceanothus prostratus*), greenleaf manzanita (*Arctostaphylos patula*), Carey's balsamroot (*Balsamorhiza careyana*), dwarf hesperochiron (*Hesperochiron pumilus*), woodland star (*Lithophragma parviflora*), chocolate lily (*Fritillaria lanceolata*), and two desert parsleys (*Lomatium triternatum* and *L. nudicaule*). Perhaps because of the recent wildfire, the peony plants had been heavily browsed. Brown's peony began flowering in late April and continued through May. In late August I gathered about 50 seeds from several plants that successfully bore mature fruit, although not all seeds were well developed.

Brown's peony browsed by a large ungulate, presumably elk. Photo by Nan Vance.

In 2007 I came across Brown's peony growing on Puffer Butte, above the Grand Ronde River in the foothills of the Blue Mountains a few miles north of the Oregon border in Washington. There, I found scattered peony plants growing at the edge of a mixed ponderosa pine/Douglas fir forest and into an adjacent open meadow at about 4,600 ft. on a south-facing slope. The bunchgrass opening, dominated by Idaho fescue and bluebunch wheatgrass (*Pseudoroegneria spicata*), was punctuated by brilliant flowering herbs and a few scattered pine trees. At this higher elevation, Brown's peony and other herbs normally flower later than at the other two sites, from mid-May to mid-June, when moist soil and warm temperatures favor rapid growth and maturity. Other herbs flowering at that time included sicklepod rockcress (*Arabis sparsiflora*), arrowleaf balsamroot, yellowbells (*Fritillaria pudica*), ballhead waterleaf (*Hydrophyllum capitatum*), scarlet gilia (*Ipomopsis aggregata*), silky lupine (*Lupinus sericeus*), *Lomatium* sp., bluebells (*Mertensia oblongifolia*), shootingstar (*Dodecatheon* sp.), spreading phlox (*Phlox diffusa*), and larkspur (*Delphinium nuttallianum*) Peonies sheltered by the forest were typically robust, with red stems as large in diameter as a garden hose, and usually produced large fruit packed with seeds In contrast, fruits of unprotected peonies hugging the ground in the south-facing prairie shriveled and failed to develop. It appears that on an exposed and windy aspect these plants are challenged to produce mature seeds when dry soils and hot temperatures arrive too early in the season.

At all three locations, Brown's peony was among the earliest flowering species, occasionally flowering when it was either snowing or snow was still on the ground. All flower buds were terminal and appeared before the leaves had fully expanded. As the buds began to open, I could see the stigmas and a few closed anthers through the sheen of clear viscous nectar. During the first several days of anthesis, the petals retracted enough to expose the receptive stigmas while occluding the anthers which had not yet dehisced or shed pollen. Stigmas were receptive for only about two days, during which time a few anthers had begun to shed pollen.

Pollen was released progressively over a span of roughly two weeks, beginning with stamens closest to the ovaries and continuing outward centrifugally; each day several of the 60 to 90 anthers dehisced, shedding thousands of pollen grains. Within a colony, not all flowers opened at the same time, so flowering continued for about a month. The lobed disc that rings the base of the carpel secretes nectar throughout the flower's lifetime from the beginning of bud opening until the petals fall off. At any one time, only three to four out of the dozen or so lobes secrete nectar (Peter Bernhardt, pers. comm.). The yellowish fleshy lobes shrivel when flowering is over and nectar is no longer being secreted. At the same time the three to five ovaries with developing seeds swell and elongate. At the time of fertilization each ovary typically contains 19 to 20 ovules, of which about 20% develop into seeds (Peter Bernhardt, pers. comm.). Meanwhile, the senescent petals fall off the flower that hangs pendant on the curved stem. The elongated stems become increasingly decumbent as the heavy follicles swell with seeds. By late summer to early fall, they bend to the ground and the dark, leathery follicles split to release large brown seeds.

A Few Good Seeds

Of the 50 mature seeds I collected at Green Ridge, 92% were filled and appeared viable. Fully developed seeds are plump and contain a starchy white endosperm and a tiny embryo at one end. Seeds vary in size, ranging from 0.2 to 0.5 inch at their widest diameter.

Partially shaded plants of Brown's peony with stout purple-red stems and buds in early spring at the Puffer Butte location. Photo by Nan Vance.

Open flower, revealing stigmas, anthers and partially hidden lobes of the nectariferous disc. Photo by Nan Vance.

Seeds are food for rodents as well as arthropods, so animal dissemination is possible (Schlising 1976). Although birds and rodents travelling with seeds may drop or bury them, I saw no direct evidence of that; instead, I noted seedlings close to the parent plants. Sometimes seeds from a single flower germinated together to form a small cluster.

The seedling foliage also can be subject to herbivory, which results in considerable mortality. In November I planted 22 of the seeds I had collected earlier at Green Ridge in marked plots in the general vicinity of the parent plants. Most of the germinants (17) had emerged by early March of the following year when snow was still on the ground. The long cotyledons were large and almost fleshy. I followed the seedlings' progress that spring and noted that many of the developing young leaves were eaten by insects to the extent that some seedlings were reduced to stubs. I do not know if any survived. I optimistically surmise that since the peony is long-lived, replacement does not have to be a frequent occurrence, and it doesn't appear to be. Herbivory was common at the Green Ridge location and predation of flowers and fruit (at least the years I visited) occurred at all three locations I visited.

Insect Visitors and Pollinators

Based on observations at all three sites, Brown's peony exhibits floral traits that are consistent with a generalist pollination system most likely dominated by flies. The unspecialized flowers attract a diversity of visitors, some of which may serve as pollinators, which in turn ensures that pollen is transferred, even if the abundance of particular pollinators fluctuates over time.

At the Blue Mountains reserve study site, the most frequent insect visitors that carried pollen of Brown's peony were large flower flies and predatory wasps. The most common were the Bombus-mimicking fly, *Criorhina caudata* (Syrphidae), and the wasp queens, *Dolichovespula arenaria* (Vespidae) and *Polistes aurifer* (Polistidae). Six species of wasps represented almost half of the visitors recorded at that location. The wasps tended to visit flowers from late morning through the afternoon after the temperature had warmed a bit. On the other hand, like other large, hairy syrphid flies, *C. caudata* actively foraged for nectar in the morning hours at the Blue Mountains site from April until the beginning of the first week in May, even on the coldest days (32°F).

Female solitary bees in the genera *Andrena* and *Lasioglossum* (*Evylaeus*) appeared to forage for nectar in mostly staminate-phase flowers, probably because they often visited the peonies late in their flowering cycle. While bees forage for nectar they accidentally pick up pollen grains. A diverse mix of pollen grains on these bees suggested that they frequented a variety of co-flowering shrubs and herbs and visited the peony flowers only for nectar. In the spring, females may take nectar back to the nest to mix with the pollen to feed the larvae; or they may stop for nectar to renew their energy while returning to their nest after gathering pollen (the bee equivalent of stopping for a double latte on the way home from work). Although bees appeared to visit Brown's peony at the Blue Mountain study site after flowers petals opened during

The fully developed fruit of Brown's peony beginning to ripen. Photo by Nan Vance.

A cluster of peony seedlings that germinated where the seeds fell from the fruit. Photo by Nan Vance.

the staminate phase, at Green Ridge and Puffer Butte I observed solitary bees visiting peony flowers throughout their lifespan.

At Green Ridge and Puffer Butte, I observed fewer wasp visits than at the Blue Mountain study site. Mostly flies, bees, and ants appeared to be foraging on the flowers. Although wasps did not appear as frequently as bees at the Green Ridge site, I saw a large (queen) hornet, *Dolichovespula adulterina,* visiting flowers and ingesting nectar; this species is an obligatory social parasite of *D. arenaria* (Greene *et al.* 1978). At Puffer Butte, I found *Bombus*-mimicking and other large flies, medium-sized bees, and large vespine wasps. Ants were more common at both of these locations than they were at the Blue Mountains reserve. Not surprisingly, where large predatory wasp and hornet visits were abundant, the visits of ants were fewer in number; conversely, ants were a frequent flower visitor where wasp visits appeared to be infrequent. Forensic evidence of the predatory nature of Vespine wasps was provided by the *P. aurifer* Peter Bernhardt captured with an ant head grasped in its tarsal claws.

The differences in composition of the insect pollinator groups among the three sites also may reflect their different geography, disturbance history, plant communities, and abundance of co-flowering species. Successfully attracting large wasps and flies does not preclude other generalist insects from functioning as effective secondary pollinators, especially if they aren't visiting flowers at the same time. For such a wide-ranging species as Brown's peony, a flexible pollination system with provision for alternative pollinators provides a buffer against changes in climate and plant and insect communities.

Why Floral Nectar?

Very few species in the genus *Paeonia* secrete floral nectar, yet Brown's peony does. And, unlike the bees and beetles that visit flowers of California peony to collect pollen and nectar (Schlising 1976), insects appear to visit Brown's peony flowers almost exclusively for nectar. Nectar attracts pollinators in early spring when their energy sources are scarce and nutritional needs are great. In fact, nectar may be critical for the survival and reproduction of pollinators at this time of year. For example, wasp queens emerging in early spring can lose up to about one-third of their body weight (Spradbery 1973). At key times in their life cycle, syrphid flies depend exclusively on high-energy nectar. Sutherland *et al.* (1999) reported that they appeared to select flowers with the greatest nectar volumes and highest sugar concentrations.

The sugar concentration of the nectar ranged between 20 and 30%, which is within the range desired by insect nectar feeders (Nicolson 1998). Both major components of peony nectar (sugar and amino acids) are important nutrients for wasp and fly pollinators (Baker and Baker 1986); for example, proline is required by wasp larvae prior to pupation (Hunt *et al.* 1998) and is readily metabolized into energy. Amino acids are also an important energy source for syrphid flies (Carter *et al.* 2006).

There was ample evidence at the Blue Mountains reserve that the wasp queens gorged on nectar during the spring months. Euthanized wasps leaked nectar when pinned and nectar volume

A large hornet queen (*Dolichovespula adulterina*) forages for nectar on a partially opened peony flower. Photo by Nan Vance.

decreased drastically in flowers visited by wasps. The wasps kept coming back even as flowers changed their appearance over the flowering period, which suggests that wasps were attracted primarily by scent of the nectar. The native peony's sugary floral nectar is an analogue of the sticky exudate of garden peonies, which would explain why the domestic peonies also have wasps and ants crawling all over them.

Prospect for the Future?

Since my first encounter with Brown's peony years ago, my attachment to this native species has deepened, as well as my understanding of its relations with the insects that depend on it for survival and in turn, contribute to its survival. Our peony is not a prolific seed producer, and it may not need to be because, as a long-lived perennial, it need only replace itself occasionally over its lifetime. Additionally, because of food reserves stored in its fleshy roots, it has the capacity to resprout after fire and herbivory which helps established colonies to persist (Page 2005). If disturbance of these habitats exceeds our peony's resilience, low fecundity could make its populations vulnerable to decline.

So, the next time you see our native peony and its lovely nodding flowers filled with nectar, think of a plant of great generosity rather than extravagance. Its cold-hardy flowers furnish nutritious, high-energy food for native insects that brave the vagaries of early spring in the interior Northwest. We are fortunate to have habitats that support populations of our native Brown's peony, an elegant denizen of Oregon's dry prairies, east side forests and Siskiyou Mountains.

Acknowledgements

I must give all credit to Professor Peter Bernhardt, Department of Biology, St. Louis University for infecting me with his enthusiasm for Brown's peony, for his vast knowledge and abundant energy in studying the pollination ecology and breeding system of this species, and for sharing key information. I also thank Andy Huber for availing us of the GROWISER study site and its facilities in the Blue Mountains Reserve of eastern Oregon. Joseph Fortier, University of Wyoming and Michael Pogue, USDA ARS, Museum of Natural History, Smithsonian Institution identified the insects. I also acknowledge the USDA Forest Service, Pacific Northwest Research Station for support and funding in part of the original study.

References

Agee JK. 1994. Fire and weather disturbances in terrestrial ecosystems of the eastern Cascades. Gen. Tech. Rep. PNW-GTR-320. Portland (OR): USDA. 52 pp.

Baker HG, Baker I. 1986. The occurrence and significance of amino acids in floral nectars. Plant Syst. Evol. 151:175-186.

Carter C, Shafir S, Yehonatan L, Palmer RG, Thornburg R. 2006. A novel role for proline in plant floral nectars. Naturwissenschaften 93:72-79.

Greene A, Akre RD, Landolt PJ. 1978. Behavior of the yellowjacket social parasite, *Dolichovespula arctica* (Rohwer) (Hymenoptera: Vespidae). Melanderia 29:1-28.

Hitchcock CL, Cronquist A, Ownbey M, Thompson JW. 1964. Vascular plants of the Pacific Northwest Part 2. Salicaceae to Saxifragaceae. Seattle (WA): Univ. Wash. Press.

Hunt JH, Rossi AM, Holmberg NJ, Smith SR, Sherman WR. 1998. Nutrients in social wasp (Hymenoptera: Vespidae, Polistinae) Honey. Ann. Entom. Soc. 91:466-472.

Nicolson SW. 1998. The importance of osmosis in nectar secretion and its consumption by insects. Am. Zool. 38: 418-435.

Page M. 2005. The Gardener's Peony: Herbaceous and Tree Peonies. Portland (OR): Timber Press.

Schlising RA. 1976. Reproductive proficiency in *Paeonia californica* (Paeoniaceae). Am. J. Bot. 63:1095-1103.

Spradbery JP. 1973. Wasps. Seattle (WA): University of Washington Press.

Stebbins GL. 1938. The western American species of *Paeonia*. Madroño 4:252-260.

Sutherland JP, Sullivan MS, Poppy GM. 1999. The influence of floral character on the foraging behaviour of the hoverfly, *Episyrphus balteatus*. Ent. Exp. Appl. 93:157-164.

USDA Forest Service. 1988. Range Plant Handbook. (Reprint of 1937 publication). Mineola (NY): Dover Press.

Nan Vance retired from the USDA Forest Service Pacific Northwest Research Station after 20 years. At the Corvallis Forestry Sciences Laboratory she led a research team that worked in restoration, conservation and sustainable management of native forest plants of the western region. Her primary research emphasis in plant physiological ecology, reproductive and conservation biology of native plants of the Pacific and Intermountain West resulted in over 40 publications. She also served as a Courtesy Graduate Faculty member in the College of Forestry and Plant Physiology Program at Oregon State University. Trained as a plant physiologist, she became interested in pollination biology in the past decade. This interest has continued after retirement through her photography and personal study of flowering plants and their insect associates in Oregon as well northcentral Idaho and southeastern Washington, where she spends her summers.

Searching for the Rare Pueblo Valley Peppergrass in Southeastern Oregon

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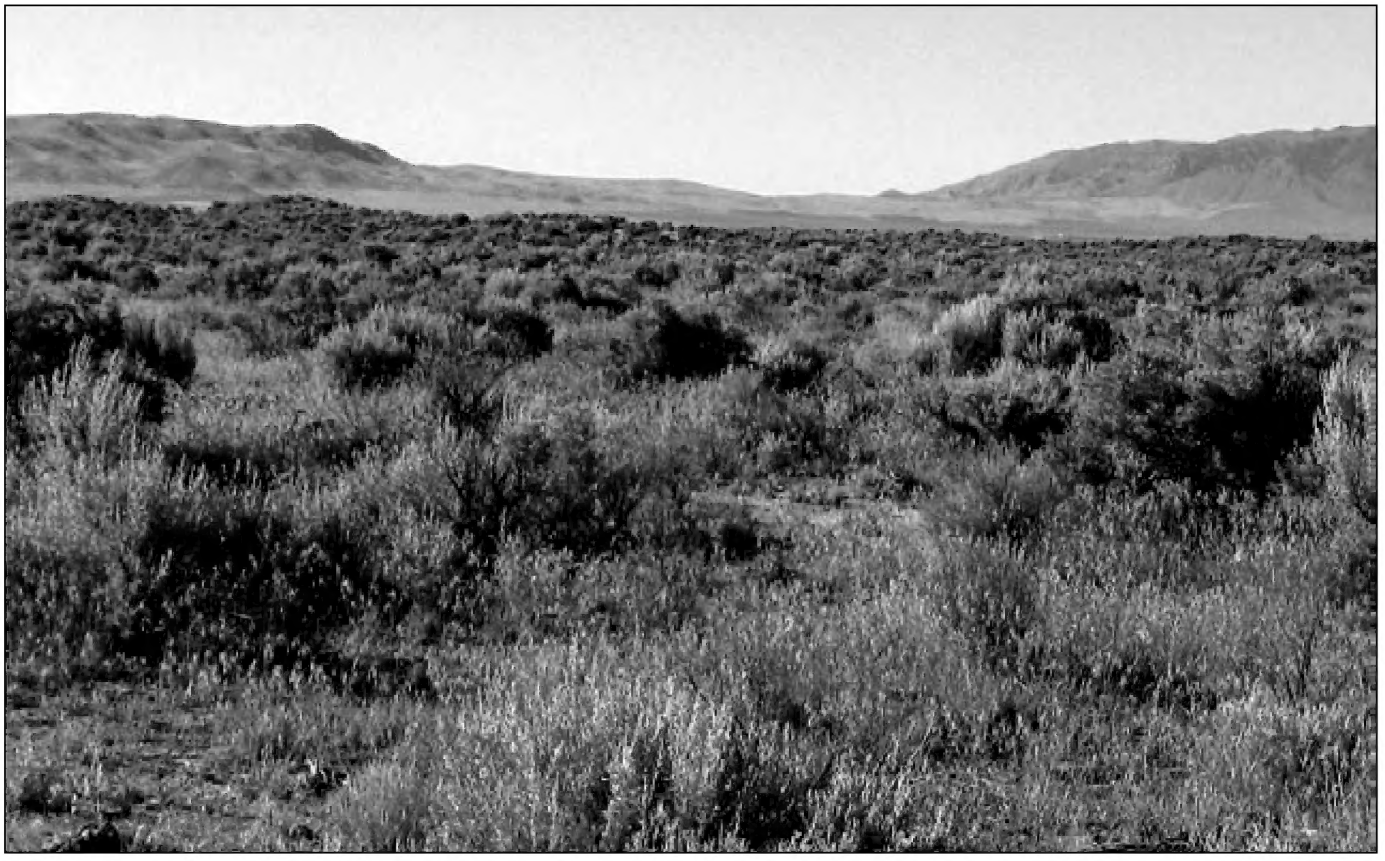


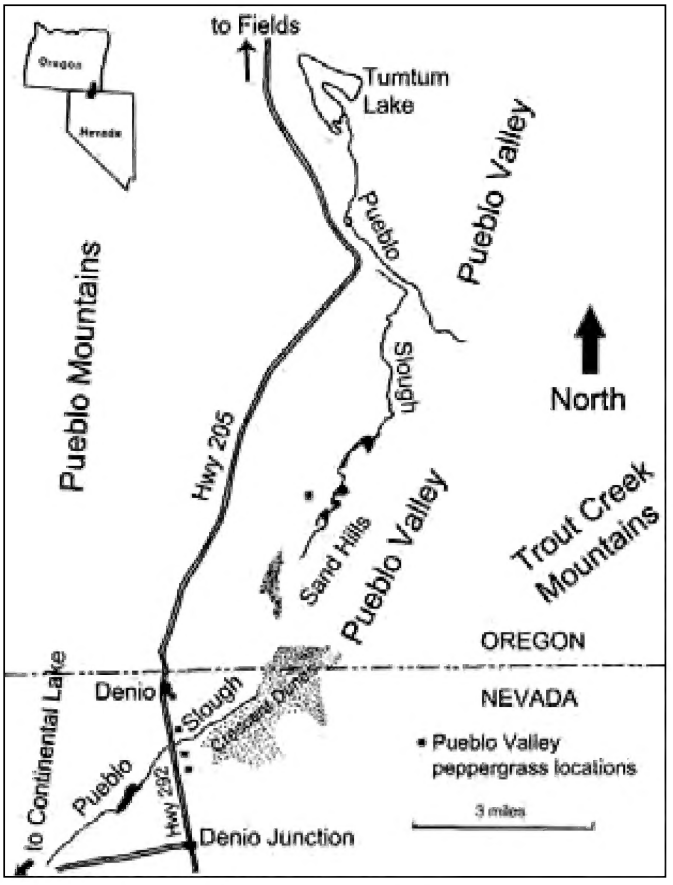
Looking south at the Pueblo Valley between the Trout Creek Mountains (left) and the Pueblo Mountains (right). Photo by Marilyn McEvoy.

Oregon is home to many members of the mustard family (Brassicaceae), native and non-native species of Crucifers, annual and perennial, common and rare. During the summer of 2009, while employed at the Burns District, Bureau of Land Management (BLM) in Harney County, I had the privilege of collecting seeds from some of Oregon's most sensitive native mustard species. These seeds were needed for ongoing research in Switzerland, a project dedicated to finding biological control agents for use on non-native mustards classified as noxious in the Pacific Northwest. This article is the result of my independent research, prompted by my concern for one of these sensitive native species and its continued survival in Oregon.

Most of Oregon's non-native mustard species are common annuals we all know: yellow alyssum (*Alyssum alyssoides*), shepherd's purse (*Capsella bursa-pastoris*), field mustard (*Brassica rapa*), and tumble mustard (*Sisymbrium altissimum*). Others are perennials that are so invasive that the Oregon Department of Agriculture classifies them as noxious weeds: perennial pepperweed (*Lepidium latifolium*), and hoary cress/white top (*Lepidium draba*). Biological control agents for these species must be tested to make sure that they will not damage rare native species, several of which grow in Oregon. Some of these rare species are Federally listed as Species of Concern and by the state of Oregon as Threatened.

Many of Oregon's rarest mustards are found only in the southeastern corner of the state, in remote, hard to find locations. Hairy wild cabbage (*Caulanthus pilosus*) is known to occur only in the Mickey Basin Hot Springs area near the Alvord Desert, while Cusick's draba (*Draba cusickii*) is restricted to Steens Mountain near Kiger Gorge overlook and Rooster Comb Ridge. Thickstem wild cabbage (*Caulanthus crassicaulis*) grows near the Nevada-Oregon border at the northern edge of the Sheldon National Wildlife Refuge in Harney County, at Oregon End Table and Long Draw. Malheur prince's plume (*Stanleya confertiflora*), and Davis pepperweed (*Lepidium davisii*) can be found in Harney and Malheur counties. Davis pepperweed, Oregon's most endangered Brassicaceae, grows only on desert playas that are alternately inundated with water and cracked by blistering sun. Pueblo Valley peppergrass (*Lepidium montanum* var. *nevadense*) is known only from a small dune area near Denio at the Nevada-Oregon border.

I looked forward to the challenge, my last assignment of the season. The idea of collecting seeds for Oregon's "war against weeds," gave me a goal towards a worthy cause. It felt more like a treasure hunt than work, even though I knew it wasn't going to be easy finding any of the target species. From preliminary seed collections in 2007, I had excellent GIS maps and aerial photographs for locations of all but one of the species. The exception was Pueblo Valley peppergrass, so I knew this species



The Pueblo Valley straddles the Oregon-Nevada line south of the Alvord Desert and is bounded by the Pueblo Mountains on the west and Trout Creek Mountains on the east. Map prepared by Cindy Roché.

would be particularly difficult to locate. Odds of success, I knew, were low; it was early August in the high desert, and it would be hard to accurately identify any one of them so late in the season. I was also concerned there might not be any seed left to collect.

The Search Begins

Over the course of a month I was able to relocate and collect seeds from all but Pueblo Valley peppergrass. A former field technician had searched for this species along the Pueblo Slough Road in 2007 without finding it. The first time I searched the area I was on my way to Oregon End Table to collect seeds of thickstem wild cabbage; my initial reconnaissance for the rare peppergrass in the Pueblo Valley was not productive. I almost gave up on it, but with perseverance and determination I eventually found it.

Pueblo Valley is a narrow basin that straddles the Oregon-Nevada border at the little town of Denio. The area is an expanse of sagebrush, sand dunes, bright green alfalfa fields, and a few modest ranch homes. Pueblo Slough parallels Highway 205 for several miles, and Pueblo Slough Road runs across the valley floor heading east from the highway. Unfortunately, no road signs are posted on the numerous dirt roads that crisscross each other, veering off in different directions across the sagebrush. Some of the roads, if you can call them that, narrowed down from dirt tracks to nothing in the thick sagebrush, or ended at fenced, irrigated hay fields. It became quite confusing, and I gave up after a couple hours of retracing my own tire tracks, going around in circles.

Disappointed and a little discouraged, I continued on my way to Oregon End Table and the wild cabbage, but I was glad I had stopped. Obviously, Pueblo Valley peppergrass wasn't going to jump out at me (there were no inflorescences to catch my attention this time of year). I knew I needed a better strategy for finding this species, other than just driving around, hoping for the best. Ironically, I wasn't aware that my route through Sheldon National Wildlife Refuge, via Highway 140, would take me by most of Nevada's well-documented Pueblo Valley peppergrass sites a few miles south of the Oregon state line (Morefield 2001).

Sleuthing the Cold Case Files

All of the information I had to date came from the field data acquired in 2007, the *Burns BLM District 2004 Special Status Plant Identification Book*, and what I could find online, but unfortunately I didn't search for Nevada's data. The next morning, I rechecked the Agency's Special Status Species botany files for *Lepidium montanum* var. *nevadense*. The BLM State Office classifies Pueblo Valley peppergrass as a "sensitive" species in Oregon, so a folder should have been in the cabinet with the other rare plant files. I didn't see one. Thinking I might find some misfiled information, I removed the bulging *Lepidium davisii* folder from the drawer to look through it, and noticed that another file, labeled *Lepidium montanum* var. *nevadense*, had slid underneath it.

The folder was so flat on the bottom of the drawer it looked

The interdune area dominated by greasewood (*Sarcobatus vermiculatus*), big and black sagebrush (*Artemisia tridentata, A. nova*), shortspine horsebrush (*Tetradymia spinosa*), rabbitbrush (*Ericameria*), and winter fat (*Krascheninnikova lanata*) is typical habitat for Pueblo Valley peppergrass. Photo by Marilyn McEvoy.

Maturing silicles (seedpods) of Pueblo Valley peppergrass. Photo by Marilyn McEvoy.

empty. Inside there was only a single sheet of faded notebook paper with four lines of cursive hand writing at the top, dated May 1987, and signed by Arnold Tiehm, the botanist who had collected a specimen and deposited it in the Burns BLM Herbarium. Scrawled out were detailed instructions to the site where he had found Pueblo Valley peppergrass in Oregon, 23 years ago! These instructions said to go north an exact number of miles on Highway 205 from the Oregon-Nevada border at Denio, then proceed east 1.5 miles along a fence line. I was flabbergasted, and wondered how long this note had gone unnoticed, and if it could actually lead me to Pueblo Valley peppergrass after so many years? I couldn't imagine how much the area had changed since then, but I knew there was a good chance that "progress" could have eliminated the population.

Following the Clues

That afternoon I drove to the Oregon-Nevada border on Highway 205, reversed my direction, keeping track of the miles ticking off on the odometer. I stopped near a ranch house on the east side of the road, and could see there were several fences running east-west, just north of the house. I didn't see any gates for access, or a dirt road running along either fence; I just about gave up, thinking the area had changed too much since Tiehm had written his directions. It was possible, however, that my measurements were in error, so I decided to drive the route again, using the tripmeter instead of the odometer.

The second time I drove north on Highway 205, the mileage took me a little further, beyond the ranch house and fences where I had stopped previously. Without a doubt, there was an east-west fence exactly where Tiehm's note said it would be. As I pulled off the highway I could see a seldom-used road (really two tire tracks) running along the fence through the sagebrush. A wire gate equipped with a cheater bar made it easy for me to enter the field, and after checking my map to make sure this was BLM land, I closed the gate, reset the tripmeter, and drove up the fenceline, per Tiehm's directions.

At the half-mile mark, the road veered north through an open gate onto a well-traveled dirt road, and because it appeared that the track ended in the sagebrush on the other side of the gate, I thought north was the only way I could go. I quickly saw signs of heavy grazing: sagebrush trampled and stripped, bare dirt and cow pies. It didn't look likely that I would find a rare plant here. I also didn't have a good feeling about turning north at the gate, away from the fence; Tiehm's note hadn't mentioned any turns or gates. But,

Flowers of Pueblo Valley peppergrass are white with the four petals typical of the mustard family. Photo by Marilyn McEvoy.

Pueblo Valley peppergrass, growing in a typical association with greasewood and saltgrass, prefers the edge of a mound and the east or north side of the bush. Here it competes with dense cheatgrass (*Bromus tectorum*). Photo by Marilyn McEvoy.

I followed the road until the truck's trip odometer read 1.5 miles anyway, and stopped. I walked through the degraded sand dunes and a few scrawny greasewood bushes (*Sarcobatus vermiculatus*), searching for over half an hour before giving in to the realization that any plants here would have been grazed down earlier in the season. There was nothing that stood out, or remotely resembled what I was looking for, except the dry clasping pepperweed (*Lepidium perfoliatum*) that formed thick mats along the roadside. I saw no identifiable forbs, only desiccated stems protruding from the sand, chomped down or broken off.

I drove on up the road, but it kept veering northward, and soon the environment no longer looked suitable for Pueblo Valley peppergrass; sand dunes and greasewood gave way to a sea of big sagebrush (*Artemisia tridentata*) that had been ravaged by cattle. Feeling a little disheartened, I turned around and headed back, stopping at the gate where I had initially turned north. For some reason, I instinctively looked left (for oncoming traffic?), and noticed the original two track I'd been following east along the fence did continue past the sagebrush. I just hadn't seen it earlier from that angle! It looked like no one had traveled this section of tracks in years, and for the first time I noticed there were no signs of grazing on this side of the fence. Feeling a renewed sense of hope, I made a sharp turn left instead of right, and drove through the sagebrush, continuing along the two-track for a little over a mile. After passing through a narrow area created by a high dune and the fence, the road opened up into a more typical desert saltbush-dune habitat. Tiehm found the peppergrass growing with *Artemisia* in interdune areas on the valley floor.

Success

Within a few minutes I found the Pueblo Valley peppergrass! I knew it instantly, even though it was desiccated and leaf-less. I was elated when I saw there were still a few seeds left in the opened pods. Single plants were scattered throughout the sand dunes, but mostly I found them in small patches of two to four plants growing along the inside edges of the dunes, mostly on the east and north sides of the greasewood. The dune ridges formed gravely, sandy bowls, or hard flat areas of caliche (hardened deposits of calcium carbonate) that appeared wind-blown or washed, where saltgrass clung to life, and obsidian flakes lay exposed. Finding the rare peppergrass became predictable, and I soon counted 44 specimens. A few plants still had a couple of green leaves left on their lower stems, but the big find was four, first-year, basal rosettes that were still green. I took photos, collected a few seeds from each plant, and recorded GPS coordinates (noting the elevation as 4,170 feet).

I had no doubt that the plants I found were Pueblo Valley peppergrass: I had Arnold Tiehm's detailed instructions to the site and his specimen in hand for comparison. I also had Reed Clark Rollins (1993) description from *Cruciferae of Continental North America: Systematics of the Mustard Family from the Arctic to Panama*. Finding the rosettes was exciting, but to collect a voucher specimen I needed an inflorescence for positive identification, and it was the wrong time of year for that. Unfortunately, I missed that opportunity the following year as well.

Finding More and More

In June 2010 I drove back to the site and photographed a few blooming plants. I was so intent on reaching my destination that I didn't pay much attention to my surroundings while driving in. However, on my way back to the highway I drove slowly, enjoying the landscape, and soon saw intermittent flashes of white: more Pueblo Valley peppergrass in bloom, scattered throughout the sagebrush. It was growing on both sides of the dirt track, and the other side of the fence where I had searched fruitlessly the year before after taking the wrong turn. Now that I could see its white flowers, it was obvious the population wasn't confined to the small area where I had found it the previous year. I stopped to scan the area and wondered about the total size of the population, and how many more plants might be out there hidden from my limited view. As I continued my drive through BLM land, I saw one more plant in the middle of the two-track, obvious to me now, that I had missed on the way in.

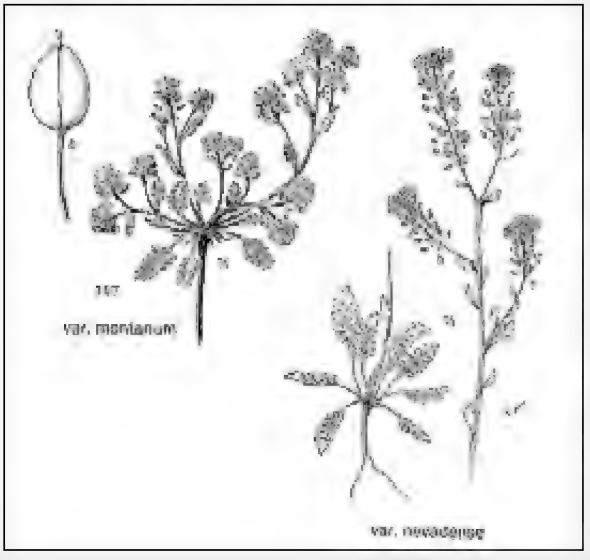
In 2010 and 2011 I returned to this small population of Pueblo Valley peppergrass, scattered along a desert dirt road, to explore the area and photograph the flowers and fruits. During my first visit in 2009 I only saw desiccated plants in the final seed dispersal stage, and I was anxious to see this little mustard in full bloom. When I returned in 2010 my time was limited to photographing a few plants along the roadside. In 2011, I followed the scattered Pueblo Valley peppergrass flowers across the dunes until I came to a small spring area and a plethora of this rare mustard growing in large patches throughout the wetlands.

Taxonomy

Pueblo Valley peppergrass is also called Nevada peppergrass or Denio pepperwort. Its other common names, mountain peppergrass, Western peppergrass, mountain pepperweed, or mountain pepperwort, are shared with *Lepidium montanum*. Numerous varieties have been described (Rollins 1993), but recent floras (*Flora of North America, The Jepson Manual*) do not recognize them (Al-Shehbaz and Gaskin 2010, Al-Shehbaz 2012). Two varieties are recognized in Oregon: var. *montanum* in Malheur County and var. *nevadense* in Harney County (Oregon Plant Atlas, http://www.oregonflora.org/atlas.php). The best key to distinguish the varieties is by Noel Holmgren in the Intermountain Flora (Holmgren *et al.* 2005).

Mountain peppergrass grows as a biennial to short-lived perennial, with one to many stems clustered on a crown that is attached directly to a taproot or from a short-branched, somewhat woody caudex. Plants range from a few inches to about 1.5 ft. tall with stems ending in a short dense raceme of white flowers. Leaves are pinnate or pinnatifid, forming a basal rosette in first year plants, and becoming progressively smaller up the stem in flowering plants. The inflorescences elongate with maturity, producing seeds in silicles (round pods). Plants may be glabrous or pubescent (Rollins 1993, Holmgren *et al.* 2005, Al-Shehbaz 2012).

The two varieties are distinguished based on number of stems and hairiness (Holmgren *et al.* 2005). The typical variety, var. *montanum* is perennial with more stems from a woodier crown, and the upper stems and inflorescence branches sparsely to densely pubescent with scale-like or club-shaped hairs (sometimes nearly glabrous). Pueblo Valley peppergrass (var. *nevadense*) is a biennial with a single stem that is completely glabrous.



Illustrations by Jeanne Janish and Laura Vogel of the two varieties of *Lepidium montanum* that grow in Oregon. Reproduced with permission of the publisher from: Noel H. Holmgren *et al.*, Subclass Dilleniidae. Intermountain Flora: Vascular Plants of the Intermountain West, U.S.A. Vol. 2B, The New York Botanical Garden Press, Bronx.

Habitat and Plant Associations

Pueblo Valley peppergrass takes its name from a narrow strip of land approximately 24 miles long that varies from two to ten miles wide (State Water Resources Board of Oregon 1967). It sits between Pueblo Mountains on the west, and the Trout Creek Mountains on the east, stretching southwest from the Alvord Desert in the north past Crescent Dunes at the state line towards Continental Lake in Nevada. The Pueblo Valley-Continental Lake watershed comprises an area of about 280 square miles in Oregon and 1,500 square miles in Nevada; Pueblo Slough Valley (110,500 acres in Harney County) is one of four sub-basins (Sinclair 1963, State Water Resources Board of Oregon 1967). The series of creeks, springs and marshes in the Pueblo Slough corridor of southeastern Oregon creates an intermittent wetland area approximately eight miles long. It includes Tum Tum Lake, a 475-acre playa that is designated as a Research Natural Area. Pueblo Slough parallels Highway 205 along the western edge of Pueblo Valley, crossing the state line and extending southwest along Highway 140 to Continental Lake where, during periods of excessive flow, Continental Lake spills northeastward through a narrow gap between the Pueblo Mountains and Pine Forest Range into Pueblo Valley and eventually ending at Tum Tum Lake.

The Pueblo Valley is an expanse of sagebrush, sand dunes, playas, and bright green (irrigated) alfalfa fields. The interdune environment consists of stabilized high sand dunes varying in height from 10 to 20 feet. There are lower mounds between the high dunes and in the interface zone from the high dunes into the saltbush desert. These smaller, irregular mounds appear washed down and composed of ash and/or clay rather than sand. Like the dunes, they are heavily vegetated with greasewood, several sagebrush species including big and black sagebrush, and less abundantly with shortspine horsebrush, rabbitbrush, and winterfat. Cheatgrass, great basin wildrye (*Leymus cinereus*), and Indian ricegrass (*Achnatherum hymenoides*) grow in the sandier areas between the mounds. By August most of the small forbs are dry stems, and unrecognizable except for the clasping pepperweed along the roadside, and occasional flixweed (*Descurainia sophia*).

The Nevada Native Heritage Program indicates that the peppergrass is "dependent on sand dunes or deep sand" (NNHP 2010). The Northern Nevada Native Plant Society describes it as likely more common along the edges of dunes (NNNPS 1999). Herbarium labels describe the environment as sandy soil on the valley floor, saline flats near hot springs, and interdune areas on the valley floor; associated species are greasewood and big sagebrush.

In August 2009, I saw only a few stems protruding from the sand and plants scattered throughout the low mounds next to greasewood, mostly on the north and east sides of the taller bushes, but I did not explore the higher dunes. When I returned in May 2010, I found hundreds of Pueblo Valley peppergrass plants thriving along the edge of a pond in the middle of the desert. This robust population's affiliation with water led me to speculate about other populations might be distributed within the Pueblo Slough watershed. When I returned in June 2010 to photograph Pueblo Valley peppergrass in flower, I counted more than 100 bright white spots scattered throughout the sagebrush, and knew the original population must be even larger than I had

Checking Herbarium Specimens

The Oregon Atlas Project shows four specimens of Pueblo Valley peppergrass, all in Harney County. Morton Peck's collection near The Narrows, in 1912, the earliest record, was identified to variety in 2009 by Richard Halse. The New York Botanical Garden (NYBG) Virtual Herbarium data base/online specimen catalog lists seven collections, including the collection by Tiehm in 1987 (www.NYBG.org). These specimens represent the documented geographic distribution of Pueblo Valley peppergrass, extending from Continental Lake in Nevada through the Pueblo Slough area in Oregon, with a disjunct site farther north at The Narrows.

Harney Co., OR: Narrows. Saline ground. M.E. Peck 5259, 3 Jul 1912. Det. Richard R. Halse. (WILLU3211)

Humboldt Co., NV: Denio, Oregon-Nevada state line. Desert valley. *Artemisia*. P. Train s.n., 21 Jun 1932. (NY76394).

Harney Co., OR: 3 mi. N. of Narrows. Low sandy ground. M.E. Peck #25287, 18 Jun 1948. Det. Richard R. Halse. (WILLU 26602).

Harney Co., OR: Malheur Wildlife Refuge. Ray C. Erickson s.n., 4 Aug 1950. Det. Richard R. Halse. (WILLU29707).

Humboldt Co., NV: Pine Forest Range, 1.5 miles south of Nevada 8A on Alder Creek Ranch road. Alt. 4250 ft. *Sarcobatus* flats. N.H. Holmgren 1322 with J. L. Reveal, 08 Jul 1964. (NY90031).

Harney Co., OR: Pueblo Slough. T41S, R35E Section 2. G. Rosenberg, 18 Jun 1980. Det. Caryn Meinicke 21 Feb 2012. (BLM Burns herbarium).

Harney Co., OR: Pueblo Valley, 2.6 road miles north of the state line on highway from Denio to Fields and Burns, then 1.6 miles northeast along a fence line road. A. Tiehm 11057, 22 May 1987. (NY76105, ORE119205).

Humboldt Co., NV: Pueblo Valley, Crescent Dunes, 1 road mile south of Denio on Highway 140, east of the highway. Plants growing with *Artemisia* in interdune areas on the valley floor. A. Tiehm 11089, 24 May 1987. (NY185232).

Humboldt Co., NV: Pueblo Valley, along State Route 140, 2.6 km (1.6 mi) south of the Oregon border (Denio), east of the highway. Mostly above the bottom flats of the slough. Among greasewood vegetation. N.H. Holmgren 13864 with P.K. Holmgren, 10 Jun 2000. (NY701805).

Humboldt Co., NV: Pueblo Valley, Crescent Dunes, along State Route 140, 1.8 km (1.1 mi) south of the Oregon border (Denio), east of the highway. Among scattered greasewood shrubs and saltgrass. N.H. Holmgren 13867 with Patricia K. Holmgren, 10 Jun 2000. (NY701806)

previously thought. With no time to explore, I took pictures of a few plants growing at road's edge, and left on my way to another assignment.

Later in June 2011, I stayed for the day, and meandered among the mounds of greasewood and a near continuous carpet of sprawling, fragrant evening primrose (*Oenothera caespitosa*). The profusion of blossoms filled the air with intoxicating scent; bees and other insects buzzed around, busy with so many flowers. Spring rains had been abundant, and flowering forbs now dotted the landscape, in striking contrast to the desiccation I saw in 2009. Sand-dune penstemon (*Penstemon acuminatus*), thread leaf phacelia (*Phacelia linearis*), and lupine stood out on the dunes, while dusty maiden (*Chaenactis douglasii*), basalt gilia (*Leptodactylon pungens*), slimpod milkvetch (*Astragalus filipes*), and wickerstem buckwheat (*Eriogonum vimineum*) added their subtle colors to the display. The real show stopper, however, was the oval-leaf cushion buckwheat (*Eriogonum ovalifolium*) with its brilliant yellow, round flower clusters that were almost as big as ping pong balls!

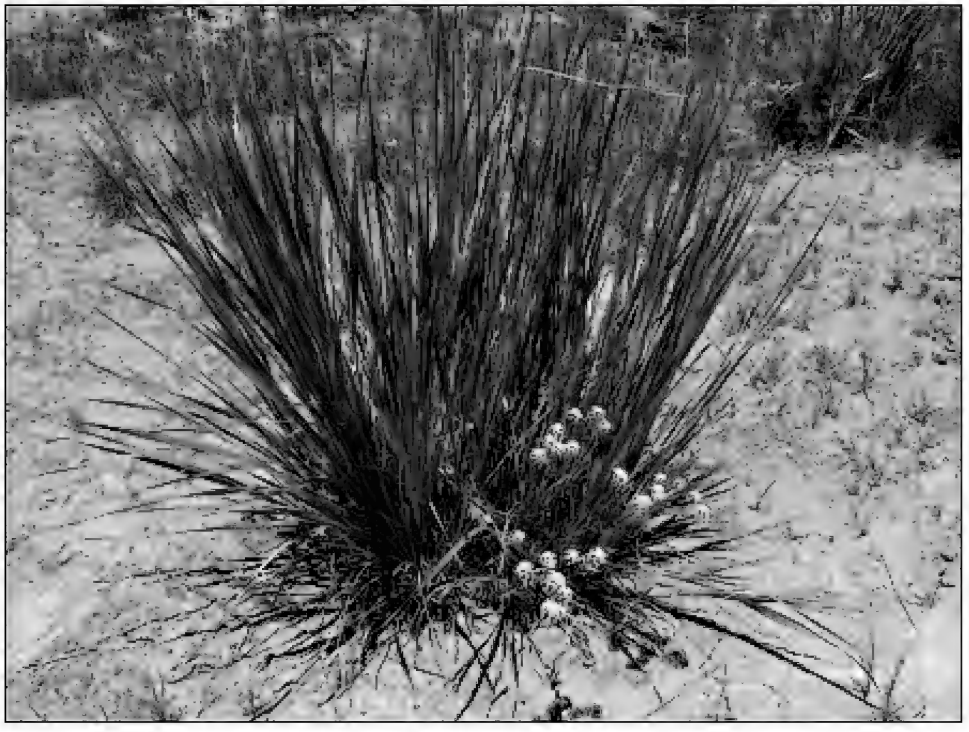
I climbed to the top of one the higher dunes, and saw a small sun-baked playa to the south. East of the playa, tucked between several dunes, was a fenced-in area that contained Russian olive trees (*Elaeagnus angustifolia*) and other bright green, water-loving vegetation. Curious, I traced my way through the dunes to this

Arthur Tiehm's 1987 collection of Pueblo Valley peppergrass. Scan courtesy of OSU Digital Collections. (oregondigital.org/cdm4/document.php?CISOROOT=/herbarium&CISOPTR=4285&CISOSHOW=3218&REC=2).

apparent oasis, and soon saw Pueblo Valley peppergrass growing everywhere in patches that became larger and more numerous the closer I got to the marsh area. Patches of alkali sacaton (*Sporobolus airoides*) hugged the edges of the dunes, and golden beeplant (*Cleome platycarpa*) grew throughout the salt grass that surrounded the marsh. Small willows (*Salix* sp.) and sedges (*Carex* sp.) grew with Pueblo Valley peppergrass next to a small pond fed by a well spring. The pond was full of cattails (*Typha* sp.) and rushes (*Juncus* sp.). I couldn't see the water, but a pair of cinnamon teals, red wing blackbirds, and a killdeer took flight as I approached their refuge. My walk took me back to the sun-baked playa, but it seemed uninviting compared to the wetland so I turned back to the dunes.

Pueblo Valley peppergrass grows in the road across the dunes. Photo by Marilyn McEvoy.

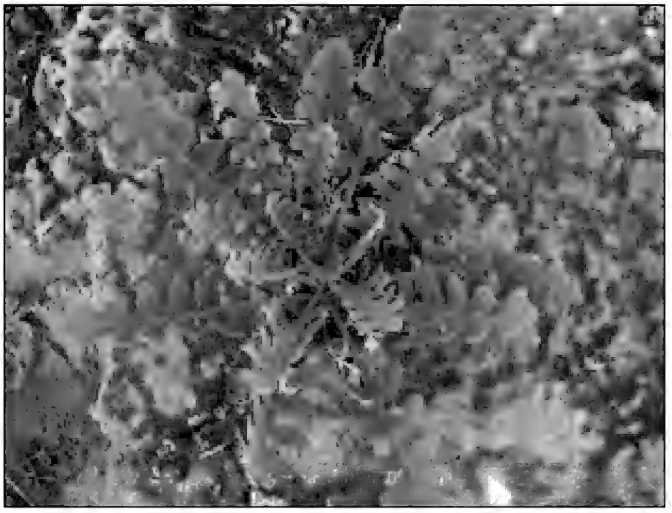
From the vantage point of a high dune I could see a few Pueblo Valley peppergrass plants scattered throughout the greasewood and sagebrush to the east, the population fading into the dunes towards the Trout Creek Mountains. The oasis area trailed off to the north becoming a sinuous snake of cattails and sedges meandering through the dunes. I scanned the Pueblo Valley peppergrass site back to its western edge towards the Pueblo Mountains and estimated the extent of the population area, from what I could see, to be about 320 acres containing around 2,000 plants, with rectangular dimensions of one mile by half mile at the population's edges. Behind me, a quarter mile away, was my vehicle, the fence line and road, and a sprinkling of Pueblo Valley peppergrass plants. Clearly, Tiehm's collection area in the dry dunes, where I had found 44 plants in 2009, lies at the most northern limit of a large population that stretches all the way to the pond and edge of the playa to the south. The healthiest and highest concentration of plants grew near the wetland and spread out into the dunes; it seemed to barely survive among the greasewood and sagebrush. My timing was perfect to observe what may be a peak population of this rare plant: two consecutive wet springs would be an absolute bonanza for a biennial.



On the dunes Pueblo Valley peppergrass grows among basin wildrye (*Leymus cinereus*). Photo by Marilyn McEvoy.

Threats

In mid July 2011 I made my last trip to the Pueblo Valley peppergrass site arriving late in the afternoon to camp out in the desert under a full moon. I enjoyed a colorful sunset and an evening hike before settling down in my tent for the night. The next day's early morning light and cool temperature provided the perfect conditions to photograph the fruiting stage of Pueblo Valley peppergrass,



As a biennial, Pueblo Valley peppergrass grows as a rosette the first year. Photo by Marilyn McEvoy.

but as the day became hot, I sought refuge in the marshy area next to the playa. My trained eye immediately picked out two perennial pepperweed plants in full bloom, growing at the edge of the cattails, only several feet away from a small patch of Pueblo Valley peppergrass. Perennial pepperweed is one of eastern Oregon's most aggressive noxious weeds, affecting thousands of acres of rangeland, and very difficult to control. It may be only a few years before this site is overrun by this aggressive weed species if measures aren't taken to control it. (ODA 2011)

I also found whitetop, another State (ODA) listed weed, growing in the center of the road near the peppergrass site. Large populations of whitetop have been documented in Pueblo Valley (ODA 2011), and this is another aggressive and rapidly spreading non-native species that prefers disturbed sites and overgrazed pastures.

When I originally researched Pueblo Valley peppergrass in 2009 it was with an eye for the assignment of finding plants, and collecting seeds from rare native mustards for a research project. However, each time I visited the site I became more concerned for its welfare and continued existence in Oregon. Pueblo Valley peppergrass's dependence on a fragile habitat makes it vulnerable to impacts of grazing, agriculture, and recreation. Now noxious weeds are threatening its survival as well. If this Pueblo Valley peppergrass population is the only site in Oregon then it's not only vulnerable, but precious as well. A full blown infestation of whitetop or perennial pepperweed could be the tipping point for its disappearance in Oregon.

A survey for Pueblo Valley peppergrass should be conducted to help determine its status in Oregon. For example, is there still a population at The Narrows where Peck collected it in 1912 and 1948? What happens to the Pueblo Slough population during a series of drought years? Question marks for rare native plant status do not help State and Federal agencies provide adequate protection. Perhaps the little mustard that fell through the cracks is worthy of protection, perhaps not. Are we willing to let it disappear without even noticing its passing? Providing answers for this seemingly insignificant native mustard will be challenging, but it will be a treasure hunt well worth the effort.

Status as a Rare Plant

While not a Federal candidate for listing as threatened or endangered, Pueblo Valley peppergrass is designated by the BLM in Oregon and Nevada as a sensitive species, either "State Director's Strategic Species" (Oregon), or "State Director's Sensitive Species" (Nevada)[1].

The Nature Conservancy's system, NatureServe/Heritage Network, ranks Pueblo Valley peppergrass as G5?T1? SNR with a "Rounded Global Status" of T1 a, "Critically Imperiled" designation based on "a very narrow range on borders of two states, [and is] rare in interdune areas on valley floor" (Morefield 2001). The NatureServe ranking system uses Global and State designations, and numerical indicators to describe a species status. "G" is a global rating and the number "5" indicates the species is "demonstrably, widespread, abundant and secure." T1 indicates a "Taxon" trinomial designation which is a "subspecies, variety or recognized race." A number "1" rank indicates the variety, in this case var. *nevadense*, may be "critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurrences. The "?" accompanying both designations means that the "5" and "1" are an "Inexact Numeric Rank" indicating the "Taxa can be ranked, but for which the rank is not certain," that "the rank is probably correct, but that either documentation is lacking or there is still some uncertainty, [s]uch ranks are always provisional." The SNR part of the ranking indicates, "State Not Ranked," and indeed the State of Oregon does not list this variety as imperiled, threatened, or even as a candidate for listing in the near future (ODA 2008). In 2010 the Oregon Biodiversity Information Center (ORBIC) ranked Pueblo Valley peppergrass as a List 3 species, a "Review" classification, which "contain taxa for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon, or throughout their range" (ORBIC 2010).

The Nevada Department of Conservation and Natural Resources Natural Heritage Program lists Pueblo Valley peppergrass as "Sensitive." Its ranking of "S1?" means the species could be "critically imperiled and especially vulnerable to extinction due to extreme rarity, imminent threats, or other factors," and "either documentation is lacking or there is still some uncertainty." The qualifying "?" indicates insufficient data for an exact ranking.

1 This special listing provides taxa that are not already included as BLM Special Status Species under Federally listed, proposed, or candidate species, or State listed species with the same level of protection as is provided for candidate species in BLM Manual 6840.07C to ensure that actions authorized, funded or carried out do not contribute to the need for the species to become listed.

References

Al-Shehbaz IA, Gaskin J. 2010. *Lepidium.* Pp. 570-595 *in* Flora of North America, Vol. 7 Magnoliophyta: Salicaceae to Brassicaceae. New York (NY): Oxford University Press.

Al-Shehbaz IA 2012. Brassicaceae. Pp. 550-556 *in* The Jepson Manual, Vascular Plants of California. Berkeley (CA): University of California Press.

Holmgren NH, Holmgren PK, Cronquist A. 2005. Intermountain Flora. Vol. 2B: Subclass Dilleniidae. Bronx (NY): New York Botanic Garden Press.

Morefield JD, ed. 2001. Nevada Rare Plant Atlas. Rare Plant Fact Sheet and mapped locations for *Lepidium montanum* Nutt. var. *nevadense* Rollins. Nevada Natural Heritage Program, compiled for the U.S. Department of Interior, Fish and Wildlife Service, Portland, Oregon and Reno, Nevada. www.heritage.nv.gov/atlas/atlas (Accessed 1/2010 and 1/2011).

Nevada Natural Heritage Program (NNHP). 2010. Department of Conservation and Natural Resources. Plant and Animal At-Risk Tracking List; Key to Symbols. 2004 (Accessed 1/10/11). Rare Species Dependent upon Dune or Deep Sand Habitats. Carson City, Nevada. www.heritage.nv.gov (accessed 10/9/2010).

Northern Nevada Native Plant Society (NNNPS). 1999. Meeting Notes from the Nevada Rare Plant Workshop. Las Vegas, NV. http://heritage.nv.gov/notes99.htm (Accessed 2/14/11).

Oregon Department of Agriculture Plant Division. 2011. WeedMapper: *Lepidium latifolium; Lepidium (Cardaria) draba*. State and County Distributions. www.weedmapper.org (Accessed 11/15/11).

Rollins RC.1993. *The Cruciferae of Continental North America: Systematics of the Mustard Family from the Arctic to Panama*. Stanford (CA): Stanford University Press. pp. 571-572, and 976.

Sinclair WC.1963. State of Nevada Department of Conservation and Natural Resources; Geological Surveys, USDI. Groundwater Resources Reconnaissance Series Report 22. Groundwater Appraisal of the Pueblo Valley Continental Lake Region, Humboldt County, Nevada: 1-2.

State Water Resources Board of Oregon 1967. Water and Related Land Resources. Malheur Lake Drainage Basin, Oregon. 156 pp. Oregon State University Libraries. http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/8421/Malheur_Lake_Drainage.pdf?sequence=1 (Accessed 10/13/11)

Originally from Florida, Marilyn McEvoy has lived in California, Alaska, Washington, and most recently eastern Oregon. Marilyn has been employed by the Harney County Weed Department, performing noxious weed surveys in the Malheur National Forest, and by the Burns District BLM as a seasonal botanist surveying rare plants and noxious weeds. Since 2005 Marilyn has worked for Berta Youtie as a botanist with Eastern Oregon Stewardship Services (EOSS) collecting native forb and grass seed for research and restoration purposes. Marilyn holds Bachelor of Art degrees in Journalism and Art. In Alaska Marilyn was self-employed as a landscaper and horticulturist specializing in native perennials, exterior seasonal plantings, and interior exotics. She has been a member of NPSO since 2010.

Greasewood is a common associate of Pueblo Valley peppergrass. Photo by Marilyn McEvoy.

Sex and the Single Saltgrass

Caitlin Coberly
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Saltgrass (*Distichlis spicata*) is widely distributed throughout the United States, from coastal marshes along the eastern seaboard south to Florida, in prairie potholes of the northern Great Plains, in the shrub steppes of the Great Basin, to the shores and estuaries along the Pacific coast (http://plants.usda.gov/). The common name saltgrass may come from the fact that this species "sweats" salt from its leaves, making it very salty on the tongue. Alternately, the name may come from the plant's ability to grow on saline/alkaline soils. A halophile (salt lover), saltgrass grows in environments that many other plants can't tolerate: coastal shores and internally drained basins. In these environments, evaporation concentrates salts to a level at which neither you (nor the neighbor's cow) can drink the water. The amount of salt exuded is related to the concentration of salt in the environment, and is thought to be an adaptation for getting rid of excess salts absorbed from the saline/alkaline soils (Kitzes 2003).

The plant's specific epithet *spicata* (Latin for "arranged in spikes") describes the spike-like inflorescences. The generic name *Distichlis* comes from the Greek *distichos* meaning two-ranked, and refers to another identifying characteristic, the way the leaves are arranged on opposite sides of the stalk (Hitchcock and Chase 1950). When viewed from above, this leaf arrangement appears flat or two-dimensional. Plants are clonal, spreading via rhizomes (underground stems), and it can be difficult to tell whether you are looking at genetically-identical ramets of a clone or a group of genetically distinct individuals.

Generally, saltgrass plants are low growing; the flowering stalks rise above the rest of the plant and may reach a foot in height. The inflorescence is pale straw yellow at maturity, while the leaves remain a dusty green year-round. The salt crystals contribute to the dusty appearance, and may provide an additional benefit for this desert plant as a sun screen.

Behind the somewhat drab appearance lies a fascinating sex story. Saltgrass hedges its bets by reproducing both asexually and sexually. Its asexual reproduction is obvious and straight-forward: rhizomes produce large clonal colonies. Sex (seed production) is a much more complicated affair, one that has multiple implications for the plant and the botanist.

Line drawing by Agnes Chase of saltgrass, showing both male plant, spikelet and floret and female panicle and floret. Note the two-ranked (distichous) leaves. Reprinted from Hitchcock and Chase (1950).

The Boarding School Model?

Saltgrass is dioecious: male and female flowers are produced on separate plants, a condition found among several members of the grass family (*Poaceae*) that ensures that offspring receive genetic material from two sources (Kellogg 2000). Species that reproduce with two parents (by outcrossing) avoid the negative genetic consequences of inbreeding, and may ensure that at least a few offspring survive environmental fluctuations.

Distichous leaf arrangement. Photo by Caitlin Coberly.

From a distance, male and female plants look similar. But if you look closely, you will notice that the males have slightly taller flowering stalks, while the plumper female flowers are clustered either within or barely above the leaves. The females also often appear slightly darker after the seeds have ripened.

Interestingly, like a single-sex boarding school, saltgrass takes gender separation one step farther than most other dioecious taxa. Not only do male and female flowers occur on separate plants, but male and female plants are further segregated by growing in slightly different environments.

Why do the saltgrass sexes grow in different environments? Why should botanists know about it? The gender distribution pattern for saltgrass is of practical interest to plant collectors, who want to collect both male and female ramets for complete specimens. Although seed collectors could work more efficiently by learning to distinguish female from male plants, male and female plants look alike with a quick glance. By knowing where to focus their search for female plants (the lower elevations), collectors can avoid having to look at each plant carefully. Plant propagators may need to control the growth environments in order to prevent favoring one gender over another.

Habitat and Gender

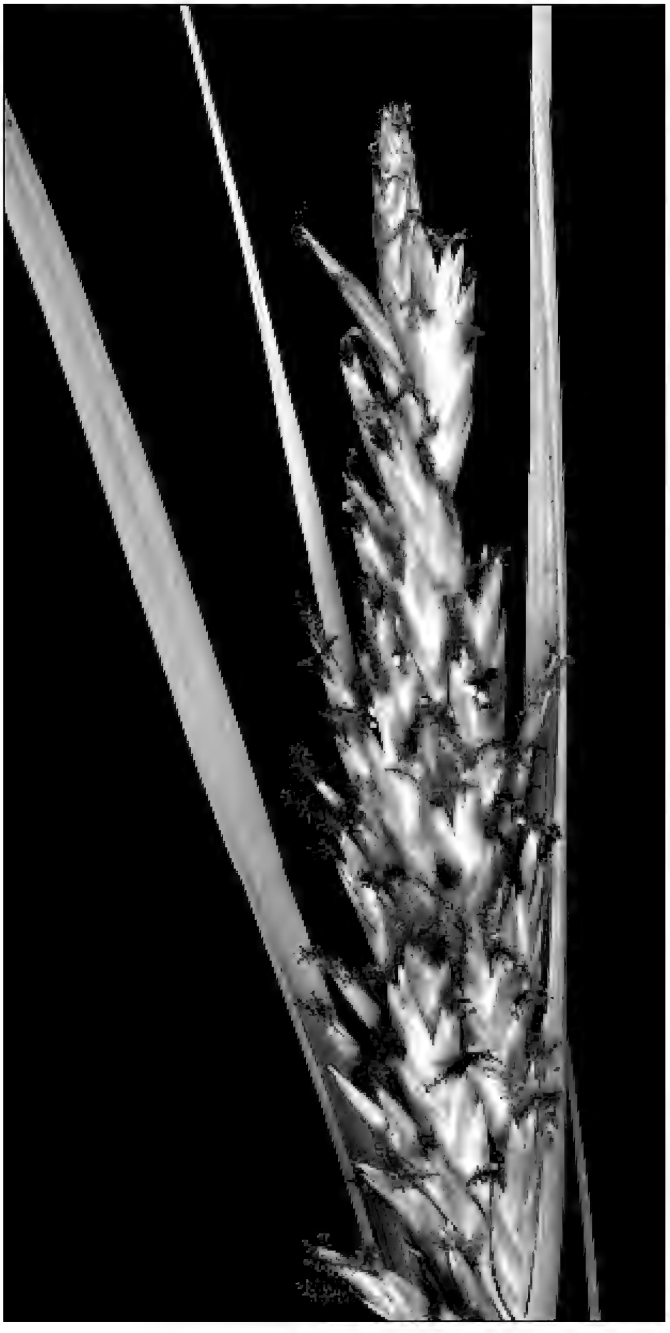
The two major habitats for saltgrass in Oregon are the shores and estuaries of the Pacific coast and surrounding alkaline lakes and in playas of the shrub steppe region. In the latter habitat, standing water appears to limit saltgrass on the lower side, while competition with other plants or arid conditions contain it on the uphill side. Female plants are found closer to the water, while male plants form a concentric ring above the female plants, at a slightly higher elevation. In these saline/alkaline playa rings, females are at most only a few yards from the males.

In fact, the playa ecosystem often appears to consist of series of concentric bands of different species outward and upward from the water. One such ringed ecosystem I observed was made of parallel bands, at increasing elevation from the water, of glasswort (*Salicornia rubra*), female saltgrass, male saltgrass, western wheatgrass (*Pascopyrum smithii*), and sagebrush *(Artemisia tridentata*). A similar pattern has been reported in salt marshes on the East coast (Bertness *et al.* 1987) and California (Eppley *et al.* 1998).

Alkaline playa in the northern Alvord Desert in the Mickey Basin near Mickey Hot Springs showing saltgrass spreading in a linear fashion by rhizomes. Accompanying shrub component is black greasewood. Photo by Stu Garrett.

Is Saltgrass a Sex-changer?

In some plant species, gender is not a set character, but can change in response to environmental conditions. Thus, one question that scientists had is whether environmental conditions determine gender in saltgrass. Factors that affect spatial patterns of dioecious plants include nutrient availability, light, temperature, photoperiod, and hormones (DeSoto *et al.* 2008, Zimmerman 1991, Heslop-Harrison 1957). A good example is jack-in-the-pulpit (*Arisaema triphyllum*), a native understory arum in eastern North America. In this environment, larger plants bear female flowers, while smaller plants produce male flowers. Female-biased populations are found in brighter and richer environments, while male-biased populations are found in shadier, nutrient-poor environments (Vitt *et al.* 2003). In reciprocal transplant studies,



Female saltgrass inflorescence. Photo by Robert L Carr.

Male saltgrass inflorescence. Photo by Robert L Carr.

males became females and *vice versa* (Lovett-Doust and Cavers 1982), firmly establishing that, in this case, the environment determines gender.

The connection of females with richer sites is relatively common among sex-changing plant species, perhaps because seeds require more energy to produce than pollen (Heslop-Harrison 1957, Bierzychudek and Eckhart 1988). Plants that become females in rich environments produce the maximum number of seeds, while those that switch to male in relatively poor environments (where seed production would be very limited) still produce large quantities of pollen.

However, and despite the evidence from reciprocal transplant studies in other species, this is not the case in saltgrass. Using DNA markers, Eppley and others (1998) found that gender in saltgrass is genetically determined. Not only were they able to

show that saltgrass plants are genetically male or female, but also that there were more female plants in the lower elevations and more males in the higher elevations, thus ruling out that idea that males and females simply did not flower in the reciprocal environments. This still leaves a big question—one which might affect plant propagators. Why are the plants segregated sexually? Eppley and her team decided to test the hypothesis that males and females have different germination and survival rates in response to environmental factors.

Which Environmental Factors Are Critical?

Zonation of different species across environmental gradients is often attributed to differences in germination, survival, or competitive advantage under stress (Freeman *et al.* 1976, Emery *et al.* 2001). Suggesting a similar mechanism for the sexes does not seem so far-fetched; all it would require is a difference in selective advantages for each gender in the alternate environments. The inherently different resource needs for producing pollen and seeds would seem to provide plausible traits upon which natural selection could act.

Is it Salt?

Evaporation of salts near the water line concentrates salts there, and waves lapping against the shore cause minerals to precipitate out at different locations. In California saltmarsh soils where concentrations of phosphates are highest, female saltgrass plants dominate (Eppley 2006).

If salt causes differences in survival and reproduction, then we would expect the frequency of one gender would be higher under high salt conditions. However, Eppley (2001) found that not only do male and female plants survive across a broad range of saline conditions, both genders also germinate across a broad range of salt concentrations. Thus, salinity doesn't segregate males from females.

Is it the Water?

Water is a scarce commodity in desert environments, and playas are surrounded by an obvious gradient of decreasing availability. Water could easily be a critical environmental factor in the "seed is expensive, pollen is cheap" hypothesis. Soil moisture is plentiful for vegetation of the inner rings of the playa, at least during the spring when seeds are developing, but is increasingly scarce with distance from the waterline.

Eppley (2001) did indeed find an affect of water, but not for the reasons one might expect. Nearly twice as many female as male plants survived inundation from a high tide event. Interestingly, this experiment did not show that females at lower, and thus wetter, elevations produced more offspring. Instead, it showed a difference in survival. No factors affecting female survival in the higher elevations has been found—thus leaving us with the mystery as to why female plants are found less frequently at higher elevations in the playa.

Eppley's studies (2006) have identified other factors affecting sex-ratio and spatial segregation. Female plants outcompete male saltgrass plants. Female plants also appear to be preferentially colonized by mycorrhizal fungi, which could increase their competitive advantage over male plants in harsh environments (Eppley *et al.* 2006). Finally, and of some importance to plant propagators wishing to maintain balanced sex ratios or good seed set, Eppley (2001) showed a strong female bias in germinating seedlings (more females germinate than males in the laboratory), suggesting the sex-ratio of seeds may be strongly female biased.

What Mystery Remains?

Research to date has found differences in germination, survival, competitive ability, and mycorrhizal colonization between male and female plants. More females than males germinate under Eppley's experimental conditions. Female plants appear to survive inundation better than male plants. Female plants are competitively dominant over male plants—males, in the presence

Female (left) and male (right) saltgrass plants, showing differences in robustness and stalk length of male and female plants. Photo by Robert L. Carr.

of females, are stunted, whereas the presence of male plants has no effect on the size of female plants. And finally, female plants are preferentially colonized by mycorrhizal fungi, possibly increasing their salt or drought tolerance.

However, the mystery remains as to *why* some saltgrass plants do better in one environment over another; *i.e.*, what mechanism allows female plants to survive inundation that is lethal to male plants? The mystery also remains as to what produces the male-biased populations; is it reduced survival of females under drought conditions, particularly during seed production?

How these known and unknown advantages and disadvantages interact with spatial and temporal environmental conditions has not been fully explored. Saltgrass is a rich subject for studying evolution of plant gender, sex-ratios, sexual segregation, and is possibly relevant for the study of dioecy itself.

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I am deeply indebted to the many people who have obliged me by discussing grasses and plant mating system evolution. In particular, I would like to thank my editor, Dr. Cindy Roché, Dr. Christina Muirhead (University of California), Dr. Cindy Salo of Sage Science, Dr. Halse of the OSU Herbarium, and Dr. Barbara Wilson of the Carex Working Group. Their ideas and questions have enriched this paper immensely.

References

Bertness MD, Wise C, Ellison AM. 1987. Consumer pressure and seed set in a salt marsh perennial plant community. Oecol. 71:190-200.

Bierzychudek P, Eckhart V. 1998. Spatial segregation of the sexes of dioecious plants. Am. Nat. 132(1):34-43.

DeSoto L, Quintanilla LG, Méndez M. 2008. Environmental sex determination in ferns: effects of nutrient availability and individual density in *Woodwardia radicans*. Ecol. 96(6):1319-1327.

Eppley SM, Stanton ML, Grosberg RK. 1998. Intrapopulation sex ratio variation in the salt grass *Distichlis spicata*. Am. Nat. 152(5):659–670.

Eppley SM. 2001. Gender specific selection during early life history stages in the dioecious grass *Distichlis spicata*. Ecol. 82(7):2022-2031.

Eppley SM. 2006. Females make tough neighbors: sex-specific competitive effects in seedlings of a dioecious grass. Oecol. 146(4):549-554.

Emery NC, Ewanchuk PT, Bertness MD. 2001. Competitors and salt-marsh zonation: stress tolerators may be dominant competitors. Ecol. 82(9):2471-2485.

Freeman DC, Klickoff LG, Harper KT. 1976. Differential resource utilization by the sexes of dioecious plants. Sci. 193:597-599.

Heslop-Harrison J. 1957. The experimental modification of sex expression in flowering plants. Biol. Rev. 32(1): 38–90.

Hitchcock A, Chase A. 1950. Manual of the Grasses of the United States. Washington (DC): US Govt. Printing Office.

Kellogg EA. 2000. The grasses: a case study in macroevolution. Ann. Rev. Ecol. Syst. 31:217-238.

Kitzes J. 2003. http://www.mbari.org/staff/conn/botany/seagrass/justin/index.htm

Lovett-Doust J, Cavers PB. 1982. Sex and gender dynamics in jack-in-the-pulpit, *Arisaema triphyllum* (Araceae). Ecol. 63(3):797-808.

Vitt P, Holsinger KE, Jones CS. 2003. Local differentiation and plasticity in the size and sex expression in jack-in-the-pulpit, *Arisaema triphyllum* (Araceae). Am. J. Bot. 90:1729-1735.

Zimmerman JK. 1991. Ecological correlates of labile sex expression in the orchid *Catasetum viridiflavum*. Ecol. 72(2):597-608.

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Marys Peak Scenic Botanical Area

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Marys Peak from Fitton Green Natural Area near Corvallis at sunset. Marys Peak is the highest point (4,097 feet) in the Oregon Coast Range. Photo by Phillip Hays.

At 4,097 ft, Marys Peak[1] is the highest mountain in the Coast Range of Oregon and is a prominent landmark in the central Willamette Valley. Its summit offers panoramic views of the Cascade Mountains, Willamette Valley and the Pacific Ocean. The paved roads and extensive trails allow easy access for recreation on the peak. Marys Peak is located 15 miles southwest of Corvallis at the western edge of the Willamette Valley and 25 miles from the Pacific Ocean. It is about an hour drive from Philomath and Corvallis by U.S. Highway 34 and the Marys Peak Forest Roads 30 and 3010. It is less than three hours driving time from the large metropolitan centers of Portland, Eugene, and Salem.

In 1989 the Siuslaw National Forest established the Marys Peak Scenic Botanical Special Interest Area (SBSIA) in recognition of its scenic, botanical and recreational values. The 924-acre SBSIA is located on the higher elevations of the peak. There are about 130 acres of grass meadows on the top of the mountain. A xeric rock garden is to the southwest of the summit and pure stands of noble fir (*Abies procera*) grow on the peak. The headwaters of Parker Creek start as a spring in the dense noble fir forest just below the summit.

Vegetation

Marys Peak is on the eastern edge of the Coast Range Physiographic Province (Baldwin 1992, Franklin and Dyrness 1988) and located in the Coast Range Ecoregion (Loy *et al.* 2001). The vegetation of the lower elevations of Marys Peak is typical of the Coast Range Province, however the higher elevation plant communities on the peak are unusual in the Coast Range. The SBSIA encompasses several vegetation types, including noble fir forest, Douglas fir forest, riparian, grassland and rock garden.

1 Place names in the United States generally do not use the possessive apostrophe on federal maps and signs. The United States Board on Geographic Names, which has responsibility for formal naming of municipalities and geographic features, has deprecated the use of possessive apostrophes since 1890 so as not to show ownership of the place.

Floristics

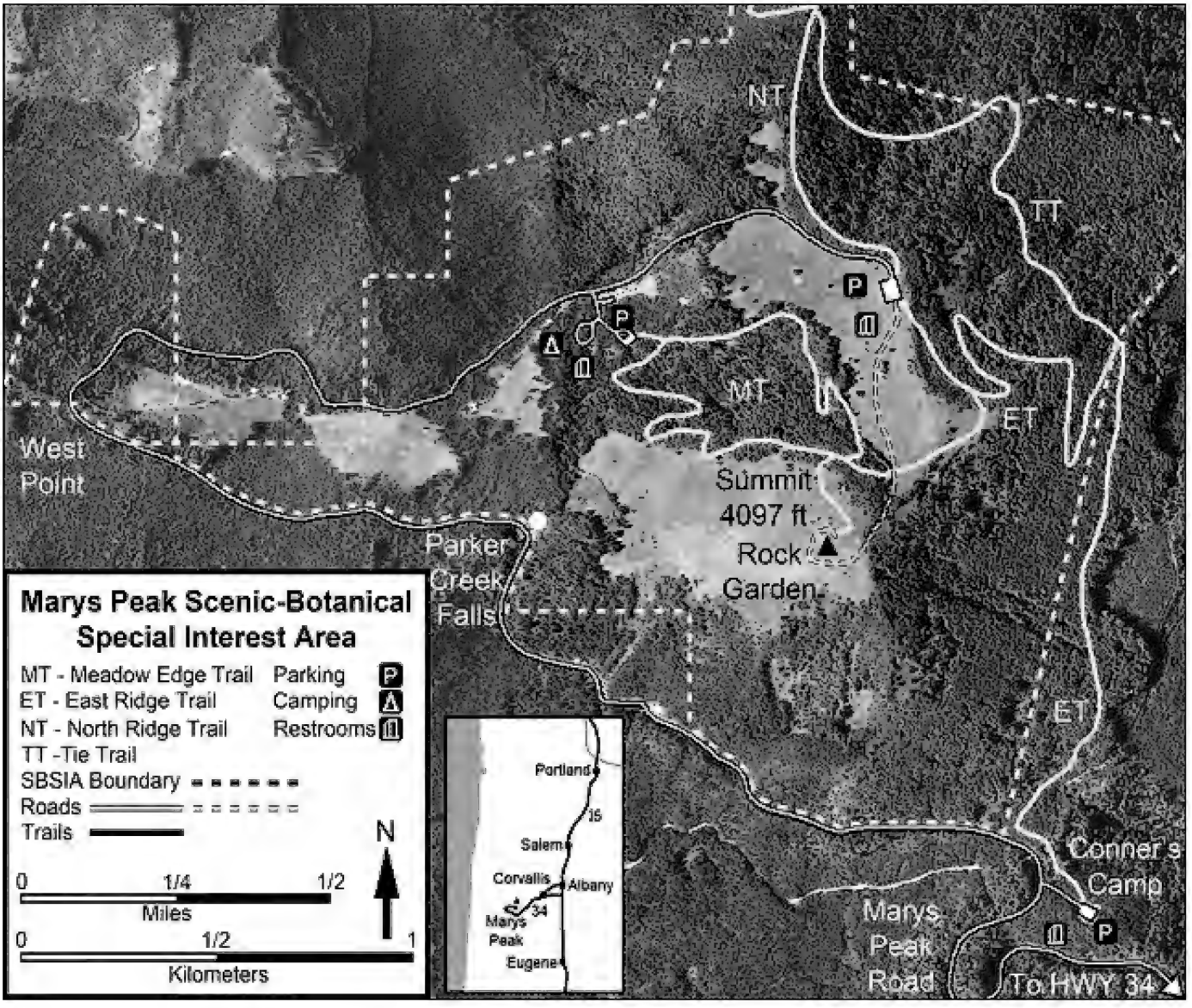
Marys Peak is of special botanical interest because of its many diverse plant communities. In a study of disjunct species with xeric affinities west of the Cascades, Detling (1953) examined several Coast Range and western Cascade mountains, including Marys Peak. He hypothesized that during the warm dry period that prevailed between 6,000 and 4,000 years ago, a xeric flora advanced from southern and eastern Oregon into more mesic northwestern Oregon. Subsequently, when conditions became moister and cooler, these xeric species persisted in thin-soil habitats on mountain tops. For example, prostrate lupine (*Lupinus lepidus*) was thought to have originated in central Oregon, and sulphur flowered buckwheat (*Eriogonum umbellatum*) from the Rogue area. The affinities of the flora with more northern and more montane elements is evident in the dominance of noble fir and small assemblages of plants that emerge at the edge of melting snow, such as glacier lily (*Erythronium grandiflorum*).

Plant Communities

Forest Types

The moist north slopes are dominated by noble fir near the top, and by Douglas fir (*Pseudostuga menziesii*) and western hemlock (*Tsuga heterophylla*) at lower elevations. Trees on the lower ridges are younger because of past fires, but some larger trees have survived in the valleys. The drier east slopes support old growth Douglas fir at lower elevations, which is gradually replaced by noble fir near the top. Douglas fir also dominates the south-facing slopes at lower elevations, with a band of vine maple at the border with the meadows near the top. The windward west slopes, wet in winter and dry in summer, sustain forests of hemlock and Douglas fir.

Although the lower slopes of the mountain have been logged extensively, the only logging in the summit area was a small salvage operation in the 1980s to remove wind-thrown trees from a campground. The mountain has been burned occasionally as evidenced by tree age structure, snags, charcoal and fire scars. Two



Marys Peak is located 15 miles southwest of Corvallis and about 25 miles from the Pacific Ocean. At the top of the mountain is the Marys Peak Scenic Botanical Special Interest Area. Map prepared by Phillip Hays.

fires, one on the north-facing slope in 1908 and another on the west-facing slope in 1932, did not reach the summit (Merkle 1951).

The almost pure noble fir forest at the summit of Marys Peak is the most extensive stand of this species in the Coast Range. First described by Merkle (1951), this stand extends in elevation slightly above the Western Hemlock Zone. The noble fir forest is about 150 to 200 years old with only a few sentinels of 250 years. These huge trees form a closed canopy high above a dense carpet of Oregon woodsorrel (*Oxalis oregana*) and other herbaceous flowering plant species. Wind damage to the forest is apparent, especially as gaps created by windfalls at the forest-meadow edge.

Noble fir rarely forms extensive stands and its distribution is limited to elevations above 3,500 ft (Franklin and Dyrness 1988) in the Cascade and Coast ranges in the Pacific Northwest and northern California. It is found mostly in the Cascade Range with isolated populations on peaks in the Willapa Hills of southwestern Washington extending south into the Coast Range of Oregon.

Riparian

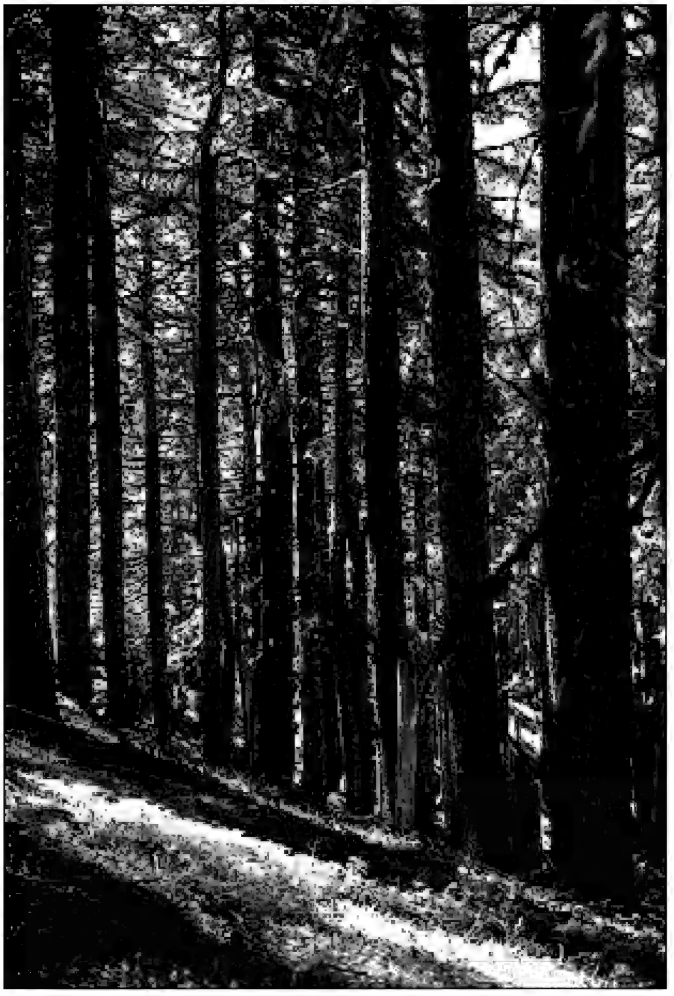
Parker Creek originates in the noble fir forest on the north slope of the peak. A narrow riparian strip lines the creek which plunges west and southward from the summit. Many species grow only in or near the stream, including slender bog orchid (*Platanthera stricta*), star-shaped mitrewort (*Mitella caulescens*), false bugbane *(Trautvetteria carolinensis*), twisted stalk *(Streptopus amplexifolius*), and trillium-leaved oxalis *(Oxalis trilliifolia*). The creek cascades down to Parker Creek Falls, bordered in the summer with the yellow flowers of clasping arnica (*Arnica amplexicaulis*).

Grassland Types

A grass bald of about 130 acres forms a prominent feature at the top of the mountain. Growing among the dense grasses are many showy forbs, including an extensive population of tiger lilies (*Lilium columbianum*) that color the meadow orange in summer. Western fritillaries, swallowtails and blue butterflies gather nectar from lilies, violets, yarrow and other perennials in the meadows.

Snow (1984) identified three grass and forb associations in the bald: a *Festuca roemeri/Agrostis diegoensis/Carex californica* community, an arrowleaf groundsel (*Senecio triangularis*) community and an Oregon iris (*Iris tenax*) community. The fescue/bentgrass/sedge community dominates most of the bald area; prominent forbs in it include tiger lily and western longspur violet (*Viola adunca*). This community has three phases: a species-poor dry phase on south slopes, a forb-rich assemblage on west slopes that is dominated by bracken fern (*Pteridium aquilinum*), and a disturbed phase with forbs, grasses and some ruderal species. The arrowleaf groundsel community grows on the north-facing slopes and in sheltered areas at meadow edges. In this type, areas around deep snowbanks have large populations of glacier lily, which is unusual in the Coast Range. These meadows are dotted with these bright yellow lilies in late spring just after the snow melts. The iris meadow in the saddle between the peak and the west point is home to wild strawberry (*Fragaria virginiana*) and field chickweed (*Cerastium arvense*).

The originally expansive, inter-connected meadow system has been significantly reduced in size by the encroachment of noble fir. This trend of shrinking grassland/meadow extent has been observed over the entire Pacific Northwest region during the past century. Five open grassy meadows in the Oregon Coast Range, including those on Marys Peak, decreased by 66% during the past 50 years, primarily from trees establishing along the margins (Zald 2009). Even so, among the mountains studied, Marys Peak had the smallest relative decline in grass bald area (-34%). Recently, this forest encroachment has been relatively rapid, at 0.3 to 1.6 feet per year (Hadley and Savage 1996).



The almost pure forest of noble fir (*Abies procera*) on Marys Peak is the largest stand in the Coast Range. Photo by Bob Frenkel.

Tree invasion is controlled by environmental factors (soil, light and moisture) as well as by plant competition factors. Peak years for tree seedling establishment coincide with abundant rain during the growing season, mineral soil exposure, deep snow, reduced meadow vegetation and proximity to already established trees (a seed source). In a study of the stability of the boundary between the noble fir forest and grassland on Marys Peak, Magee and Antos (1992) recognized four ecotones in which noble fir trees are actively invading the meadows. The type most susceptible to tree invasion was the moist forb/grass type, *Festuca roemeri/Elymus glaucus/Agrostis diegoensis,* in which forbs and graminoids share dominance almost equally. Also fairly susceptible were a red fescue/sedge type with *Maianthemum stellatum* and *Viola glabella*, and the grass-dominated meadow with bracken fern and Cardwell's penstemon (*Penstemon cardwellii*). The type least susceptible to tree invasion was the grass/sedge type dominated by *Festuca roemeri/Carex californica*, likely because a deep accumulation of graminoid litter formed a thatch over the soil surface. However,

Lomatium martindalei in the rock garden. Photo by Phillip Hays.

distance to seed sources and plant competition also play a role.

Although tree invasion increased during the past 100 years of fire suppression, the role of fire in maintaining the distinctiveness of the grassland is unclear, because it can't be separated from other factors (*e.g.,* reduced ignitions by Native Americans, grazing and cessation of grazing associated with European settlement). It is believed that "even infrequent fires. . . could maintain the meadow" (Magee and Antos 1992). Federal land management agencies (Forest Service and BLM) are removing small trees to restore the meadows to what is believed to be the size before fire suppression and to improve the area for scenic viewing. Where the meadows have been segmented by narrow strips of forest, the infilling trees will be removed (McCain 2011, pers. comm.).

Rock Garden

One of the most botanically interesting features of Marys Peak is the summit rock garden of subalpine wildflowers, a lithosolic community on thin gravelly soil with a south to southwestern exposure. The rock garden is an area of steep slopes just below the summit that is exposed to direct hot sunlight and steady westerly breezes in summer that produce arid conditions. Winter storms blow away most of the snow, leaving scant snowpack to moisten the ground in spring. Vegetation is sparse on the gravelly soil and includes spreading phlox (*Phlox diffusa*), harsh Indian paintbrush (*Castilleja hispida*), scalloped onion (*Allium crenulatum*), cascade desert parsley (*Lomatium martindalei*), prostrate lupine and Cardwell's penstemon. Paintbrush and penstemon display splashes of vivid scarlet and purple among the rocks.

In contrast to the rock garden, a particularly lush community of native forbs and grasses thrives in the area around the rock garden and extending to the top of the peak. In late spring and early summer the area around the summit is a breath-taking display of colorful flowers, abounding with bluefield gilia (*Gilia capitata*), rough wallflower (*Erysimum capitatum*), Menzies' larkspur (*Delphinium menziesii*), spreading phlox, Douglas' silene (*Silene douglasii*), sickle keeled lupine (*Lupinus albicaulis*), western woolly sunflower (*Eriophyllum lanatum*), western groundsel (*Senecio integerrimus*), Oregon fescue (*Festuca roemeri*) and many others. On warm sunny days, blooming wallflowers fill the air with a fragrant scent.

Botanists

Many botanists have collected on Marys Peak. In July 1881 Louis Henderson wrote that he was surprised to find many of

Allium crenulatum in the rock garden. Photo by Phillip Hays.

the grasses and some flowers of eastern Oregon on top of Marys Peak (Henderson 1881). Morton Peck who wrote the only flora of Oregon, *A Manual of the Higher Plants of Oregon*, collected on Marys Peak as did Helen Gilkey who wrote the *Handbook of Northwestern Plants* with LaRea Dennis. Other botanists who have visited and collected on the peak include Francis Ownbey, a specialist in *Calochortus* and *Allium*, Judith Jernstedt who specializes in the systematics of Liliaceae and Kenton Chambers, a taxonomist at Oregon State University who specializes in the Asteraceae.

History

The stories and original name of Marys Peak used by the early American Indians are not well documented. Marys Peak was a sacred place for spirit quests for the Kalapuya tribe, a native people of western Oregon (Juntunen *et al.* 2005). Early European settlers drove cattle, sheep and goats to the meadows on the peak for summer forage.

In 1906 Corvallis started using water from the Rock Creek watershed on the eastern side of Marys Peak. This watershed area was almost all private land; logging operations threatened the water quality so after World War I the city of Corvallis began purchasing land in the watershed to ensure a clean water supply for the future. The lands in the Marys Peak area were added to the Siuslaw National Forest in 1940 following a purchase and land exchange. The Rock Creek Municipal Watershed on the east slope of the mountain currently supplies 40% of the city's water. The watershed encompasses about 10,000 acres and is publicly owned; it is managed by the city of Corvallis, the Forest Service and the Bureau of Land Management (BLM). The BLM portion within the SBSIA is designated an Area of Critical Environmental Concern (ACEC).

A three-level log fire lookout constructed in 1942 at the summit of Marys Peak was replaced with a newer structure in 1959. The Air Force extended the road to the summit in 1958 and built a radar station as part of the Cold War Continental Air Defense System. The site was completed in 1959, but before the radar could be put into operation a storm blew away the antenna, so the site was abandoned in early 1960. The Air Force removed all the equipment and transferred the building to the Forest Service. This was the start of the current electronics site on the peak. The fire lookout structure was removed and two structures remain on the peak for radio communications. Currently there are two primary users of the buildings on the summit, Bonneville Power Administration (BPA) and the Forest Service. BPA operates their own equipment and the Forest Service building houses a number of permit users. Two other electronic sites on the mountain are visible from the summit: a Federal Aviation Administration site near the campground and one owned by the City of Corvallis on the west point.

In the fall of 2011 the Forest Service installed a fence and lightning protection around the communication site on the summit. They trenched and bulldozed a large area of the protected native plant community on the peak, enlarging the disturbed area by about four times. Removal of topsoil and native vegetation has opened the area to erosion and weed invasion. The work ignored the goals of minimal disturbance to the native plant communities that are stated in all applicable management plans (USDA Forest Service 1989). The Forest Service now promises to restore the fragile habitat. We hope that they are successful, so that future visitors will be able to enjoy the native wildflowers as we have for so many years.

Recreation

Throughout the year Marys Peak SBSIA is used by a variety of recreationists. There are an estimated 93,900 visitor days to the area annually. A road initiated by the crews of Work Projects Administration (WPA) and the Civilian Conservation Corps (CCC) was completed in 1941 and provides public access to a campground, a trail complex and a parking area below the summit. Four established trails on the mountain top provide hiking, biking and access for the public through the forests and native plant communities. Bikes are restricted in the summit area.

Phlox diffusa grows on the rocks in the rock garden at the top of Marys Peak. Photo by Bob Frenkel.

In 1981 extreme wind storms struck the Coast Range and buried the old campground under fallen trees. The campground and picnic area were moved to the present site. A local group called the Helonskis Ski Club operated a ski tow on the summit from 1942 to 1952 but abandoned it because the snow pack is unpredictable from year to year. Between 1946 and 1984 the Shriners held an "Annual Trek to Marys Peak" each August. The

Lilium columbianum in the meadows at the top of Marys Peak. Photo by Phillip Hays.

event eventually became a fund raiser to help support the Shriners Crippled Children Hospitals. Estimates of up to 12,000 people attended this event and there is still evidence of barbecue pits and other uses from the past in the meadow below the parking area at the top. Special use permits have been issued for different activities including research projects, noble fir cone collection and recreation events. In order to protect the sensitive scenic and botanical values the Forest Service created the Meadow Edge Trail to minimize the impacts on the fragile plant communities in the meadow area. In 1986, snowmobile use was restricted on Marys Peak. Activities on the summit such as unauthorized off road vehicles and vandalism constitute major disturbances to the area today.

Geology and Soils

The geology of Marys Peak creates the environment for the plant communities on the mountain. The determining factor is the position of the Oregon Coast Range at the western edge of the North American Tectonic Plate. The tectonic plates that form the Pacific Ocean floor and the Juan de Fuca Plate to the west of the Coast Range are moving northeastward. As these oceanic plates collide with the North American plate they plunge beneath it, causing uplift and generating volcanic activity.

A string of undersea volcanoes (seamounts) and volcanic islands that had formed offshore about 60 to 50 million years ago collided with and were accreted to the North American plate to produce the core of today's Coast Range. These newly arrived oceanic rocks had formed as thick basalt lava flows on the ocean floor. Today, they include the Siletz River volcanics that compose much of the base of Marys Peak (Baldwin 1955, 1992). Erosion of onshore rocks produced sediments that flowed into the ocean to form thick layers on the ocean floor that overlie the older basalts and appear today as the sandstone and siltstone beds of the Tyee Formation (Fluornoy Formation) and Kings Valley Siltstone (Ryu *et al.* 1996, Wells *et al.* 2000).

Uplifting and faulting of the Oregon Coast Range began about 40 million years ago as it was accreted to North America. By 30 million years ago, this subduction process also produced magma that was injected as younger basalt intrusions (*e.g.*, sills and dikes) into the Coast Range sedimentary rocks and older oceanic basalt. Differential erosion of the softer Tyee Formation sandstones and Kings Valley siltstones from around the resistant basalts of the ancient sea floor and younger intrusions have formed the Coast Range peaks. Marys Peak is the highest of these mountains, with an approximately 1,000-foot thick cap of erosion resistant coarsely crystalline basalt or gabbro sill of one of these intrusions. The sill that forms the upper part of Marys Peak is about 30 million years old (Orr *et al.* 1992).

Baldwin (1993) examined the Oregon Coast Range for evidence of glaciations and on Marys Peak he identified four cirque-like features in the gabbro of the summit with unconsolidated debris

Erythronium grandiflorum var. *grandiflorum* growing in the meadows at the top of Marys Peak. Common in the Cascades, this species is found only on a few of the highest peaks in the Coast Range. Photo by Esther McEvoy.

accumulation at the base of each. He speculated that this topography on the northeast exposure was probable early stages of glaciation, during the end of the last ice age about 12,000 years ago. However, no clear evidence of glaciation on Marys Peak has been reported.

The older Siletz River volcanic rocks can be observed as pillow basalt, basaltic breccia, and some columnar-jointed basalt sills and dikes in cuts along the first few miles of the Marys Peak Road. An example of thick-bedded fine-grained Tyee Formation sandstone and intervening thin-bedded siltstone is exposed 6.5 mi. from the beginning of the Marys Peak Road. Parker Creek waterfall (at 6.7 mi.) displays the erosion resistant gabbro cap of Marys Peak. The intrusive gabbro elsewhere grades into a granophyric diorite comprising the coarse parent material for the soils of the grassland and rock garden (Lawrence *et al.* 1980).

Noble fir (*Abies procera*) is slowly encroaching into the meadows at the top of Marys Peak. The Forest Service is removing young trees at the edge of the meadows to preserve the open habitat. Photo by Esther McEvoy.

The two primary soil series in the SBSIA are the Mulkey Series in the open meadows and the Maryspeak Series on the slopes (Fillmore 2009). The Mulkey Series are moderately deep well-drained loamy soils derived from coarse-grained intrusive igneous rock. These soils are rich in organic matter because they developed under grasslands, but contain gravels and cobbles from rocks disintegrating in place or sliding downslope (residuum and colluvium).

The Maryspeak Series are well-drained sandy loams that formed on ancient deposits from sandy colluviums derived from a mixture of sandstone and coarse-grained intrusive igneous rock. Maryspeak soils are found under forests surrounding the meadows and on mountain slopes (Fillmore 2009).

Climate

The high elevation and proximity to the Pacific Ocean are the dominant features influencing the climate and weather on Marys Peak. The climate is maritime with an annual precipitation of 100 to 120 inches; mostly falling as rain or snow and rain from October to May. Less than 5% of the yearly precipitation arrives in the summer. Winter temperatures range between 20 and 50°F and snow falls occasionally from November to June, but there is no such thing as a normal snow year on the Peak. Summer temperatures range between 40 to 90°F with winds typically no more than 20 mph.

The elevation of Marys Peak causes extremes in weather conditions that affect the distribution of the vegetation. Powerful winds up to 100 mph and periods of winter thaw prevent snow accumulation on the south and west slopes, but snowdrifts up to 10 feet deep pile up on sheltered north and east slopes. Some plants are found only where the deepest snow packs melt late in the spring. Thick rime accumulations build up on objects near the summit in winter. The upper reaches of the noble fir forests on the north side of the peak show stunted growth caused by significant breakage due to strong winds and heavy accumulations of snow and ice. Magnificent old growth Douglas fir trees on the relatively sheltered eastern slopes benefit from heavy rainfall in the winter and collect moisture from frequent fogs and clouds in the summer. All around the top of the peak variations of exposure to wind, sun and moisture create numerous micro habitats each with its own distinct assemblage of plants. For example, xeric conditions prevail on shallow soils on the southwest side of the summit that are exposed to direct summer sunlight and constant desiccating breezes from the west.

Planning a Wildflower Walk on Marys Peak

Marys Peak has four primary trails for access to different parts of the mountain (shown on map). The shortest and easiest route is from the parking area near the top of the mountain along a dirt road to the summit. This trail gains 350 feet in two thirds of a mile to the top, where there are many beautiful native wildflower gardens in June and July.

The Meadow Edge trail starts at the parking area of the Marys Peak Campground 8.6 miles from the junction of Highway 34. It is a fairly easy loop of 1.6 miles with an elevation gain of about 500 feet. The trail crosses Parker Creek and climbs through the almost pure noble fir stand. A short side trail leads to the summit. You can also access this trail from the dirt road leading up from the parking lot at the top.

The East Ridge trail starts from Connors Camp parking lot on Marys Peak Road 5.5 miles from the junction with Highway 34. The trail is 3.5 miles with a 1400-foot elevation gain. The trail climbs through old growth Douglas fir forests at low elevations into noble fir forest at the top. Part way up the Tie Trail forks to the

Beargrass (*Xerophyllum tenax*) grows in a small area of the meadows at the top of Marys Peak. It is much more common on the lower slopes of the mountain. Photo by Phillip Hays.

north and crosses the steep east face of the mountain to connect to the upper end of the North Ridge Trail. Near the top of the East Ridge Trail a side trail leads to the parking area, or one can continue to the summit.

The North Ridge Trail is accessed from the Woods Creek Road by proceeding west on US 20 (Corvallis-Newport Highway) for 1.7 miles from the junction of US 20 and Highway 34 at the west end of Philomath, turning south on the Woods Creek Road and continuing 7.5 miles to a parking area at the gated trailhead. The trail gains 2,200 feet in elevation over 5.5 miles to the parking lot near the top. This is a more difficult trail, but it climbs through a beautiful old growth Douglas fir forest.

Sunny days from spring through summer are the best times to visit the mountain to observe the diversity of plants in the Scenic Botanical Area. Keep in mind, however, that the weather varies greatly from year to year, so the flowering periods can shift by a month or more, and sometimes the peak is sunny when it is raining or snowing at lower elevations

There are three periods during the spring and summer that provide the best floral displays. The first is in late spring from early May to late June. Most of the snow will have melted and the roads will be open, but the last snow banks usually remain on the northeastern slopes of the peak. As the snow pack recedes, glacier lilies emerge by pushing through the thin snow and ice. This display lasts barely a week. This is a good time to walk the East Ridge Trail, Tie Trail and North Ridge Trail loop to view the early spring flowers. It can be very chilly and windy at the top with snow flurries and chilling winds, so come prepared with warm clothing, raingear, waterproof boots, food and water.

The second is from the middle to late June through July which has spectacular flowering, especially in the meadows around the very top of the peak. This is when the rock garden is at its best with plants such as scalloped onion, harsh Indian paintbrush, Cardwell's penstemon, and spreading phlox. The noble fir forest floor along Parker Creek is lush with a carpet of Oregon wood sorrel and many other plant species. Parker Creek is lined with a variety of flowering plants including arrowleaf grounsel. This is a good time to walk the Meadow Edge Trail. There is an illustrated pocket guide to the wildflowers of Marys Peak with colored photos of some of the common plants (Carpenter 2009).

The third display is a bit later in July, when the meadows may be filled with tiger lilies and other summer flowers. The abundance of tiger lily flowers appears to depend on an interaction of spring weather and deer populations: during nice springs large deer populations eat the lily buds, while inclement spring weather keeps the deer lower on the mountain. On a really clear day one can see the major Cascades peaks from Mt. Rainier in Washington to Mt. Thielsen in southern Oregon. To the west you can see the Pacific Ocean and maybe even waves crashing on the beaches.

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References

Baldwin EM. 1955. Geology of the Marys Peak and Alsea quadrangles, Oregon: US Geological Survey Map OM-162, scale 1:62,500.

Baldwin E. 1992. Geology of Oregon. Dubuque (IA): Kendall Hunt Publishing Company.

Baldwin E. 1993. Glaciations in the Central Coast Range of Oregon. Oregon Geology 55:87-89.

Carpenter SE. 2009 Wildflowers of Marys Peak Meadows. Philomath (OR): Abbey Lane Laboratory, LLC.

Detling LE. 1953. Relict islands of xeric flora west of the Cascade Mountains in Oregon. Madroño 12:39-47.

Fillmore MH. 2009. Soil Survey of Benton County Oregon. USDA Natural Resources Conservation Service.

Franklin JF, Dyrness CT. 1988. Natural Vegetation of Oregon and Washington. Corvallis (OR): Oregon State University Press.

Hadley KS, Savage M. 1996. Wind disturbance and development of a near-edge forest interior, Marys Peak, Oregon Coast Range. Physical Geogr. 17(1):47-61.

Henderson, LF. 1881. Early experiences of a botanist. NPSO Bulletin 14(11):4-7.

Juntunen JR, Dasch M, Rogers AN. 2005. The World of the Kalapuya: a Native People of Western Oregon. Philomath (OR): Benton County Historical Society and Museum. 128 pp.

Lawrence RD, Rosenfeld CL, Ruddiman W. 1980. Marys Peak field trip: structure of the eastern flank of the central Coast Range, Oregon. Pp. 121-131 in Geologic Field Trips in Western Oregon and Southwestern Washington. Oregon Dept. Geology and Mineral Industries Bull. 101.

Loy WG, Allan S, Buckley AR, Meacham JE. 2002. Atlas of Oregon. Eugene (OR): Univ. Oregon Press. 301 pp.

Magee TK, Antos JA. 1992. Tree invasion into a mountain-top meadow in the Oregon Coast Range, USA. Jour. Veg. Sci. 3:485-494.

Merkle J. 1951. An analysis of the plant communities of Marys Peak, western Oregon. Ecol. 32:618-640.

Orr EL, Orr WN, Baldwin E. 1992. Geology of Oregon. Dubuque (IA): Kendall/Hunt Publ. Co. 254 pp.

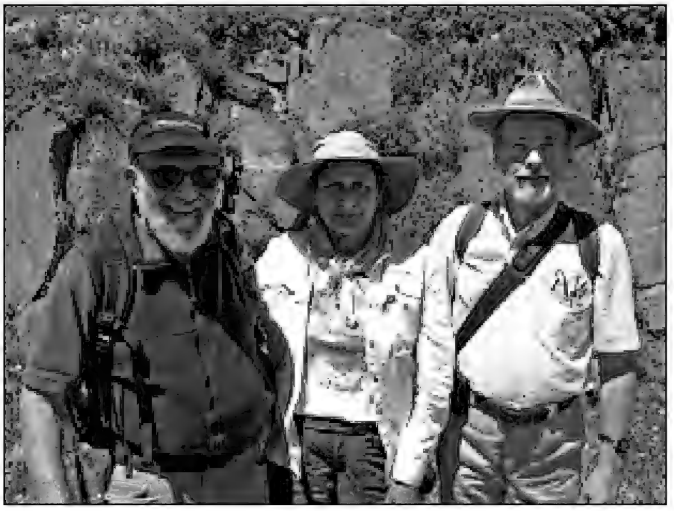
Ryu I, Niem AR, Niem WA. 1966. Oil and gas potential of the southern Tyee basin, southern Oregon Coastal Range: Oregon Dept. Geology and Mineral Industries Oil and Gas Investigation 19. 141 pp.

Snow BD. 1984. Plant Communities of the Grassy Balds of Marys Peak, Oregon. MS Thesis, Oregon State University, Corvallis, OR.

USDA Forest Service. 1989. Marys Peak Scenic Botanical Plan. USDA Forest Service, Siuslaw National Forest. Corvallis.

Wells RE, Jayko AS, Niem AR, Black G, Wiley T, Baldwin E, Molemnaar KM, Wheeler KL, DuRoss CB, Givler RW. 2000. Geologic map and database of the Roseburg 30x60"quadrangle. Douglas and Coos counties, Oregon. USGS Open File Report 00-376, 2 plates + 55p.

Zald H. 2009. Extent and spatial patterns of grass bald land cover change (1948-2000), Oregon Coast Range, USA. Plant Ecol. 201:517-529.



(L to R) Bob Frenkel, Esther McEvoy and Phillip Hays at the rock garden at the top of Marys Peak. Photographer unknown.

Phillip R. Hays has a BS in Bacteriology from the University of Arkansas in 1968 and a PhD in Microbiology from Oregon State University in 1978. He became interested in the botany of the Corvallis area in the 1980s and since then has been photographing and drawing the plants of Benton County, Oregon. He has been a member of NPSO since the late 1980s. He wrote "A Guide to Trails in the Corvallis Area" and often leads hikes for the Corvallis Chapter. Phil is Chair of the Benton County Natural Areas and Parks Advisory Board and is a member of the Corvallis Parks, Natural Areas and Recreation Advisory Board. He was a founding member of the Greenbelt Land Trust in Corvallis and currently serves on the Lands Committee.

Robert E. Frenkel has a BA in chemistry from Kenyon College, Ohio 1950; MS in metallurgy in 1954 and PhD in geography 1967 from UC Berkeley, and taught geography at OSU since 1965. He retired as Emeritus Professor in 1997. Bob joined NPSO in the early seventies, working with Jean Sidall and Ken Chambers. He was appointed by Governor McCall as Chair of the Natural Preserves Advisory Committee whose mission was to recommend potential natural areas to the State Land Board. He became fascinated in the flora and vegetation of Marys Peak after first climbing the old ungraded north trail in 1965.

Esther Gruber McEvoy joined NPSO while working for the Bureau of Land Management as a botanist on rare plants in Burns Oregon in 1979. She has a BA in Art from Lewis and Clark College and a BA in Science from Portland State University. In 1980 she helped start the Corvallis Chapter and remains active in the chapter. She worked for the Willamette National Forest in 1981 documenting old growth forests in the coast range. In 1983 and 1984 she worked with Bob Frenkel at Finley National Wildlife Refuge monitoring vegetation changes of a Willamette prairie after burning. In 1994 and 1995 she worked on the dynamics of a *Sidalcea hirtipes* population on the Oregon coast. In 2000 she started Willamette Gardens, a native plant nursery in Corvallis, Oregon which specializes in container grown native plants.

MARYS PEAK SCENIC BOTANICAL AREA PLANT SPECIES LIST

FAMILY: GENUS AND SPECIES	FAMILY: COMMON NAME	HABITAT	NOTES
FERNS AND FERN RELATIVES			
BLECHNACEAE	DEER FERN FAMILY		
Blechnum spicant	Deer fern	Forest	
DENNSTAEDTIACEAE	BRACKEN FAMILY		
Pteridium aquilinum	Bracken fern	Forest, Moist Meadows	
DRYOPTERIDACEAE	WOOD FERN FAMILY		
Polystichum munitum	Swordfern	Forest	
LYCOPODIACEAE	CLUB-MOSS FAMILY		
Lycopodium clavatum var. *integrifolium*	Common clubmoss	Forest	
OPHIOLGLOSSACEAE	ADDER'S TONGUE FAMILY		
Botrychium multifidum	Leathery grapefern	Riparian	
PTERIDACEAE	MAIDENHAIR FERN		
Adiantum aleuticum	Western maidenhair fern	Riparian	*Adiantum pedatum*
Cryptogramma acrostichoides	Rock brake	Rock cliffs	*Cryptogramma crispa*
WOODSIACEAE	CLIFF FERN FAMILY		
Athyrium filix-femina	Lady fern	Forest	
CONIFERS			
CUPRESSACEAE	CYPRESS FAMILY		
Thuja plicata	Western red cedar	Forest	
PINACEAE	PINE FAMILY		
Abies grandis	Grand fir	Forest	
Abies procera	Noble fir	Forest	
Pseudotsuga menziesii var. *menziesii*	Douglas fir	Forest	
Tsuga heterophylla	Western hemlock	Forest	
TAXACEAE	YEW FAMILY		
Taxus brevifolia	Western yew	Forest	
FLOWERING PLANTS:DICOTS			
ADOXACEAE	MUSKROOT FAMILY		
Sambucus mexicana	Blue elderberry	Forest	
Sambucus racemosa var. *arborescens*	Red elderberry	Riparian	
APIACEAE	CARROT FAMILY		
Ligusticum apiifolium	Clery-leaved lovage	Meadow	
Lomatium martindalei	Cascade desert parsley	Rock Garden	
Lomatium utriculatum	Spring gold	Meadow	
Osmorhiza purpurea	Purple sweet cicely	Open Forest	
Sanicula crassicaulis	Snakeroot	Open Forest	
APOCYNACEAE	DOGBANE FAMILY		
Apocynum androsaemifolium var. *pumilum*	Dwarf dogbane	Rock Garden, Meadow	
ARALIACEAE	GINSENG FAMLY		
Oplopanax horridus	Devils club	Forest	
ARISTOLOCHIACEAE	DUTCHMAN'S PIPE FAMILY		
Asarum caudatum	Wild ginger	Forest, Riparian	
ASTERACEAE	SUNFLOWER FAMILY		
Achillea millefolium	Yarrow	Meadow	
Adenocaulon bicolor	Pathfinder	Forest	
Agoseris grandiflora	Agroseris	Open Forest, Meadow	
Anaphalis margaritacea	Pearly everlasting	Meadow	
Anisocarpus madioides	Woodland tarweed	Forest	*Madia madioides*
Arnica amplexicaulis	Clasping arnica	Riparian	

FAMILY: GENUS AND SPECIES	FAMILY: COMMON NAME	HABITAT	NOTES
* *Bellis perennis*	English lawndaisy	Meadow	
Cirsium edule var. *edule*	Indian thistle	Meadow	*Cirsium hallii*
* *Cirsium vulgare*	Bull thistle	Meadow	
* *Crepis capillaris*	Smooth hawksbeard	Meadow	
Eriophyllum lanatum var. *leucophyllum*	Western woolly sunflower	Meadow, Rocky	
Euribia radulina	Rough leaved aster	Dry Forest	*Aster radulinus*
Hieracium albiflorum	White flowered hawkweed	Open Forest	
* *Hypochaeris radicata*	Hairy catsear	Meadow	
Lactuca biennis	Tall blue lettuce	Moist Areas	
* *Lapsana communis*	Nipplewort	Forest	
* *Leucanthemum vulgare*	Oxeye daisy	Meadow	*Chrysanthemum leucanthemum*
* *Matricaria discoidea*	Pineapple weed	Roadside	*Matricaria matricarioides*
Petasites frigidus var. *palmatus*	Western coltsfoot	Moist Woods	
Senecio integerrimus var. *exaltatus*	Tall western groundsel	Meadow, Rock Garden	
* *Senecio jacobea*	Tansy ragwort	Meadow	
* *Senecio sylvaticus*	Wood groundsel	Roadside	
Senecio triangularis var. *triangularis*	Arrowleaf groundsel	Forest, Meadow	
* *Tanacetum vulgare*	Common tansy	Meadow	
* *Taraxacum officinale*	Common dandelion	Meadow	
BERBERIDACEAE	**BARBERRY FAMILY**		
Achlys triphylla	Vanilla leaf	Forest	
Berberis aquifolium	Tall Oregon grape	Forest	*Mahonia aquifolium*
Berberis nervosa	Cascade Oregon grape	Forest	*Mahonia nervosa*
Vancouveria hexandra	White inside out flower	Forest	
BETULACEAE	**BIRCH FAMILY**		
Alnus rubra	Oregon alder, red Alder	Riparian	
Corylus cornuta var. *californica*	California hazelnut	Forest	
BORAGINACEAE	**BORAGE FAMILY**		
Hydrophyllum occidentale	Western waterleaf	Forest, Riparian	
Hydrophyllum tenuipes	Pacific waterleaf	Forest, Riparian	
Nemophila parviflora var. *parviflora*	Wood nemophila	Forest	
Phacelia heterophylla ssp. *virgata*	Varileaf phacelia	Roadside, Rocky	
Phaceilia nemoralis	Woodland phacelia	Moist Forest	
Romanzoffia sitchensis	Sitka mistmaiden	Rocky	
BRASSICEAE	**MUSTARD FAMILY**		
Cardamine nuttallii	Spring beauty	Forest	*Cardamine pulcherrima*
Cardamine oligosperma	Little western bittercress	Moist Meadows	
Draba verna	Spring whitlow grass	Meadow	
Erysimum capitatum var. *capitatum*	Rough wallflower	Rock Garden	
Turritis glabra	Tower mustard	Roadside	*Arabis glabra*
CAMPANULACEAE	**HAREBELL FAMILY**		
Campanula scouleri	Scouler's harebell	Forest, Riparian	
CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**		
Lonicera ciliosa	Orange honeysuckle	Open Forest	
Symphoricarpus albus var. *laevigatus*	Common snowberry	Forest	
Symphoricarpos mollis	Creeping snowberry	Open Forest	
CARYOPHYLLACEAE	**PINK FAMILY**		
Cerastium arvense ssp. *strictum*	Field chickweed	Meadow	
* *Cerastium fontatum* spp. *vulgare*	Big chickweed	Meadow	*Cerastium vulgatum,* misapplied
* *Dianthus armeria* ssp. *armeria*	Deptford pink	Roadside	
Moehringia macrophylla	Bigleaf sandwort	Forest	*Arenaria macrophylla*
Silene douglasii var. *douglasii*	Douglas silene	Rock Garden, Meadow	

FAMILY: GENUS AND SPECIES	FAMILY: COMMON NAME	HABITAT	NOTES
* *Spergularia rubra*	Red sandspurry	Roadside	
Stellaria crispa	Crisped starwort	Moist Forest	
ERICACEAE	**HEATH FAMLY**		
Arctostaphylos uva-ursi	Kinnikinnick	Forest	
Chimaphila umbellata var. *occidentalis*	Prince's pine	Forest	
Gaultheria shallon	Salal	Forest	
Monotropa hypopitys	Pinesap	Forest	*Hypopitys monotropa*
Monotropa uniflora	Indian pipe	Forest	
Pyrola asarifolia	Alpine pyrola	Moist Forest	
Pyrola picta	White-vein pyrola	Forest	*Pyrola aphylla*
Vaccinium membranaceum	Big huckleberry	Forest	
Vaccinium parvifolium	Red huckleberry	Forest	
Vaccinium scoparium	Grouse whortleberry	Open Forest	
FABACEAE	**PEA FAMILY**		
* *Cytisus scoparius*	Scots broom	Meadow	
Lathyrus nevadensis var. *nevadensis*	Sierra peavine	Open Forest	
Lathyrus polyphyllus	Leafy peavine	Roadside, Open Forest	
Lotus crassifolius var. *crassifolius*	Big deervetch	Forest, Roadside	
Lotus micranthus	Small flowered lotus	Roadside	
Lupinus albicaulis var. *albicaulis*	Sickle keeled lupine	Forest	
Lupinus latifolius var. *latifolius*	Broad leaved lupine	Open Forest	
Lupin us lepidus var. *lobbii*	Prostrate lupine	Rock Garden	
Lupinus rivularis	Riverbank lupine	Riparian, Roadside	
* *Melilotus officinalis*	Common yellow sweetclover	Roadside	
Rupertia physodes	California tea	Roadside	
* *Trifolium dubium*	Least hopclover	Roadside, Meadow	
* *Trifolium pratense*	Red clover	Meadow	
* *Trifolium repens*	White clover	Meadow	
* *Trifolium subterraneum*	Subterraneum clover	Meadow, Open Forest	
Vicia americana var. *americana*	American vetch	Roadside, Open Forest	
FAGACEAE	**OAK FAMILY**		
Chrysolepis chrysophylla var. *chrysophylla*	Golden chinquapin	Open Forest	*Castanopsis chrysophylla*
GROSSULARICEAE	**GOOSEBERRY FAMILY**		
Ribes sangineum var. *sangineum*	Red flowering currant	Open Forest	
IRIDACEAE	**IRIS FAMILY**		
Iris tenax var. *tenax*	Oregon iris	Meadow	
LAMIACEAE	**MINT FAMILY**		
Prunella vulgaris var. *lanceolata*	Native heal all	Meadow	
Satureja douglasii	Yerba buena	Forest	
Stachys mexicana	Mexican betony	Moist Forest	
Stachys rigida	Rigid betony	Moist to drier sites	
LINNAEAEAE	**LINNAEA FAMILY**		
Linnaea borealis var. *longiflora*	Western twinflower	Forest	
MONTIACEAE	**PURSLANE FAMILY**		
Claytonia sibirica	Candy flower	Forest, Riparian	*Montia sibirica*
Claytonia perfoliata ssp. *perfoliata*	Miner's lettuce	Forest, Riparian	*Montia perfoliata*
ONAGRACEAE	**EVENING PRIMROSE FAMILY**		
Chamaenerion angustifolium var. *canescens*	Fireweed	Meadow, Roadside	*Epilobium angustifolium*
Epilobium ciliatum var. *ciliatum*	Purple leaved willowherb	Riparian , Open Forest	*Epilobium watsonii*
OROBANCHACEAE	**BROOMRAPE FAMILY**		
Castilleja hispida var. *hispida*	Harsh Indian paintbrush	Rock Garden, Roadside	
OXALIDACEAE	**OXALIS FAMILY**		

FAMILY: GENUS AND SPECIES	FAMILY: COMMON NAME	HABITAT	NOTES
Oxalis oregana	Oregon wood sorrel	Forest	
Oxalis trilliifolia	Trillium leaved oxalis	Riparian	
PAPAVERACEAE	**POPPY FAMILY**		
Dicentra formosa ssp. *formosa*	Bleedingheart	Forest, Riparian	
PHRYMACEAE	**LOPSEED FAMILY**		
Mimulus alsinoides	Chickweed monkeyflower	Rocky	
Mimulus dentatus	Tooth leaved monkeyflower	Meadow, Riparian	
PLANTAGINACEAE	**PLAINTAIN FAMILY**		
Collinsia grandiflora	Large flowered blue-eyed Mary	Meadow	
Collinsia parviflora	Small flowered blue-eyed Mary	Roadside, Meadow	
* *Digitalis purpurea*	Foxglove	Roadside, Meadow	
Nothochelone nemorosa	Woodland beardtongue	Forest	
Penstemon cardwellii	Cardwell's penstemon	Rock Garden, Roadside	
Penstemon rattanii var. *rattanii*	Rattan's penstemon	Roadside	
* *Plantago lanceolata*	English plantain	Meadow, Roadside	
* *Plantago major*	Common plantain	Meadow, Roadside	
Synthyris reniformis	Snowqueen	Forest	
Veronica americana	Common speedwell	Riparian	
Veronica arvensis	Small speedwell	Meadow	
Veronica serpyllifolia var. *humifusa*	Thyme-leaved speedwell	Meadow	
POLEMONIACEAE	**PHLOX FAMILY**		
Collomia heterophylla	Varied leaf collomia	Riparian, Open Forest	
Gilia capitata ssp.*capitata*	Bluefield gilia	Rock Garden	
Microsteris gracilis	Slender phlox	Riparian, Rocky	*Phlox gracilis*
Phlox diffusa	Spreading phlox	Rock Garden, Meadow	
POLYGONACEAE	**BUCKWHEAT FAMILY**		
Eriogonum nudum var. *nudum*	Barestem buckwheat	Roadside	
Eriogonum umbellatum var. *haussknechtii*	Haussknecht's buckwheat	Rocky	
* *Polygonum aviculare*	Knotweed	Roadside	
Polygonum minimum	Broad leaved knotweed	Moist Areas	
* *Rumex acetosella*	Sour dock	Meadow	
PRIMULACEAE	**PRIMROSE FAMILY**		
Trientalis latifolia	Western starflower	Forest	
RANUNCULACEAE	**BUTTERCUP FAMILY**		
Actea rubra	Western red baneberry	Forest	
Anemone deltoidea	Threeleaf anemone	Forest	
Anemone lyallii	Lyall's anemone	Meadow	
Anemone oregana var. *oregana*	Blue windflower	Forest	
Aquilegia formosa	Red columbine	Moist Forest	
Coptis laciniata	Oregon goldthread	Forest	
Delphinium menziesii	Menzies' larkspur	Meadow, Rock Garden	
Ranunculus occidentalis	Western buttercup	Meadow	
Ranunculus uncinatus	Little buttercup	Forest	
Thalictrum occidentale	Western meadowrue	Forest	
Trautvetteria carolinensis	False bugbane	Riparian	
RHAMNACEAE	BUCKTHORN FAMILY		
Rhamnus purshiana	Cascara	Forest	
ROSACEAE	**ROSE FAMILY**		
Amelanchier alnifolia var. *semiintegrifolia*	Pacific serviceberry	Open Forest	
Fragaria vesca ssp. *bracteata*	Woodland strawberry	Meadow	
Fragaria virginiana var. *platypetala*	Wild strawberry	Meadow	
Holodiscus discolor var. *discolor*	Oceanspray	Forest	

FAMILY: GENUS AND SPECIES	FAMILY: COMMON NAME	HABITAT	NOTES
Prunus emarginata var. *emarginata*	Shrubby bittercherry	Riparian, Forest	
Rosa gymnocarpa var. *gymnocarpa*	Little wild rose	Forest	
Rosa pisocarpa	Clustered wild rose	Forest	
* *Rubus laciniatus*	Evergreen blackberry	Meadow	
Rubus parviflorus	Thimbleberry	Meadow	
Rubus pedatus	Five leafed dwarf bramble	Moist Forest	
Rubus spectabilis	Salmonberry	Riparian, Forest	
Rubus ursinus	Pacifc blackberry	Forest	
RUBIACEAE	**MADDER FAMILY**		
Galium aparine	Cleavers	Forest	
Galium oreganum	Oregon bedstraw	Shady Forest	
Galium triflorum	Fragrant bedstraw	Forest	
SALICACEAE	**WILLOW FAMILY**		
Salix species	Willows	Riparian	
SAPINDACEAE	**SOAPBERRY FAMILY**		
Acer circinatum	Vine maple	Forest	
Acer glabrum var. *douglasii*	Douglas maple	Forest	
SAXIFRAGACEAE	**SAXIFRAGE FAMILY**		
Chrysosplenium glechomifolium	Western golden carpet	Riparian	
Heuchera micrantha	Alumroot	Moist Rocky Outcrops	
Lithophragma parviflorum var. *parviflorum*	Small flowered fringecup	Meadow, Rocky	
Micranthes ferruginea	Rusty saxifrage	Riparian	*Saxifrage ferruginea*
Mitella caulescens	Star-shaped mitrewort	Riparian	
Tellima grandiflora	Large fringecup	Forest	
Tiarella trifoliata var. *trifolilata*	Trefoil foamflower	Forest	
Tolmiea menziesii	Piggyback plant	Riparian, Forest	
SCROPHULARIACEAE	**SNAPDRAGON FAMILY**		
Scrophularia californica ssp. *californica*	California figwort	Meadow	
SELAGINELLACAE	**SPIKEMOSS FAMILY**		
Selaginella scopulorum	Rocky Mountain spikemoss	Rocky	*Selaginella densa* var. *scopulorum*
VIOLACEAE	**VIOLET FAMILY**		
Viola adunca	Western longspur violet	Meadow	
Viola glabella	Stream violet	Riparian	
Viola sempervirens	Evergreen violet	Forest	
FLOWERING PLANTS: MONOCOTS			
AMARYLLIDACEAE	**AMARYLLIS FAMILY**		
Allium crenulatum	Scalloped onion	Rock Garden	
ASPARAGACEAE	**ASPARAGUS FAMILY**		
Maianthemum dilatatum	False-lily-of-the-valley	Forest, Riparian	
Maianthemum racemosum ssp. *amplexicaule*	Large false Solomon's seal	Forest, Riparian	*Smilacina racemosa*
Maianthemum stellatum	Small false Solomon's seal	Moist Forest, Meadow	*Smilacina stellata*
CYPERACEAE	**SEDGE FAMILY**		
Carex aquatilis var. *dives*	Sitka sedge	Wet Meadow	*Carex sitchensis*
Carex californica	California sedge	Wet Prairie	
Carex fracta	Fragile sheathed sedge	Wet to Dry Soil	
Carex hoodii	Hood's sedge	Moist Meadows	
Carex mertensii	Mertens sedge	Wet Areas	
Carex rossii	Ross sedge	Meadow	
JUNCACEAE	**RUSH FAMILY**		
Luzula comosa var. *laxa*	Pacific woodrush	Moist Forest, Rocky	*Luzula campestris*
Luzula parviflora	Small flowered woodrush	Moist to Dry Forest	

FAMILY: GENUS AND SPECIES	FAMILY: COMMON NAME	HABITAT	NOTES
LILIACEAE	**LILY FAMILY**		
Calochortus tolmiei	Oregon mariposa lily	Meadow	
Clintonia uniflora	Queencup beadlily	Forest	
Erythronium grandiflorum var. *grandiflorum*	Yellow fawnlily, glacier lily	Meadow	
Erythronium oregonum	Giant fawnlily	Meadow, Forest	*Erythronium oreganum* var. *oreganum*
Fritillaria affinis	Checker lily	Meadow	*Fritillaria lanceolata*
Lilium columbianum	Columbia or tiger lily	Meadow	
Prosartes hookeri	Hooker's fairybells	Forest	*Disporum hookeri*
Prosartes smithii	Fairy lanterns	Forest	*Disporum smithii*
Streptopus amplexifolius	Twisted stalk	Riparian	
MELANTHIACEAE			
Anticlea occidentalis	Western stenanthium	Forest	*Stenathium occidentale*
Trillium ovatum ssp. *ovatum*	Western trillium	Forest	
Xerophyllum tenax	Beargrass	Meadow	
ORCHIDACEAE	**ORCHID FAMILY**		
Cephalanthera austiniae	Phantom orchid	Forest	
Corallorhiza maculata	Spotted coralroot	Forest	
Goodyera oblongifolia	Western rattlesnake plantain	Forest	
Platanthera stricta	Slender bog orchid	Riparian	*Habenaria saccata*
Listera caurina	Northwestern twayblade	Forest	
Listera cordata	Heartleaf twayblade	Forest	
POACEAE	**GRASS FAMILY**		
Agrostis hallii	Hall's bentgrass	Forest	
Agrostis pallens	Dune bentgrass	Forest	*Agrostis diegoensis*
* *Aira caryophyllea*	Hairgrass	Gravelly Soil	
Aira praecox	Early hairgrass	Gravelly Soil	
Bromus carinatus	California brome	Moist Forest, Meadow	
Bromus hordeaceus	Soft brome	Moist Meadow	
Bromus sitchensis	Alaska brome	Meadow	
Bromus vulgaris	Common brome	Open Forest, Moist Banks, Rocky Slopes	
* *Cynosurus echinatus*	Hedgehog dogtailgrass	Open Ground	
* *Dactylis glomerata*	Orchardgrass	Meadow	
Danthonia californica	California oatgrass	Meadow, Open Forest	
* *Elymus elymoides*	Bottlebrush squirreltail	Open Forest, Rocky Slopes	*Sitanion hystrix*
Elymus glaucus ssp. *glaucus*	Blue wildrye	Open Forest	
Festuca occidentalis	Western fescue	Moist to Dry Forest	
Festuca roemeri var. *roemeri*	Oregon Fescue	Meadow	
* *Festuca rubra* ssp. *commutata*	Chewings red fescue	Meadow	
Festuca subulata	Bearded fescue	Moist, Dry Forest	
Koeleria macrantha	Prairie junegrass	Meadow	*Koeleria cristata*
* *Lolium perenne*	English ryegrass	Meadow	
Melica bulbosa	Oniongrass	Meadow	
Melica spectabilis	Purple oniongrass	Meadow	
Melica subulata	Alaska oniongrass	Dry, Moist Forest	
Phleum alpinum	Alpine timothy	Meadow	
* *Poa annua*	Annual bluegrass	Meadow	
Poa laxiflora	Loose flowered bluegrass	Moist Forest, Meadow	
Poa pratensis	Kentucky bluegrass	Moist Forest, Meadow	

* Indicates a non-native, introduced species

Norm Jensen
(1940-2012)

This is a brief glimpse into his life, jointly written from the musings and piecing together of a life by two of his good friends, Cecile Shohet and Alex Maksymowicz.

It is hard for us to know, as we didn't think to ask in time, but Norm Jensen either knew of his fascination with the flora of the Klamath-Siskiyou Mountains before he arrived in southwestern Oregon in 2001 (he was fifty-nine), or he very quickly acquired it, as evidenced by his participation in NPSO flora forays that same year. He immediately put his long-standing interest in photography to valuable use by compiling an extensive photographic record of the wildflowers of this region. His collection totals over twenty thousand superb images.

Norm Jensen at Woodcock Fen. Photo by Alex Maksymowicz.

From the start, Norm befriended many botanists at the Forest Service, BLM, Nature Conservancy, US Fish and Wildlife Service, and National Park Service, seeking their help in the identification of his photos, wanting to know more about the flora of our region and to locate botanical hotspots. He soon started volunteering his services on projects for agency personnel. His last project was collecting seeds from two wild whitebark pine trees on Mount Ashland to preserve the genome of that species in the Siskiyou Mountains.

Norm soon became an expert on the flowering plants of southern Oregon, along the way learning the detailed botanical terminology necessary to use the keys and to discuss the ecology and taxonomy of wildflowers. He even took up sparring over the correct pronunciation of Latin words! Cheerful, helpful, and fearless, he was the perfect companion on botanical expeditions.

Eventually, Norm's passion focused on finding and photographing rare wildflowers, utterly intrigued as he was by the Siskiyou endemics. He traveled extensively in our region, camping in his beloved gray van to get that magical early morning light so coveted by photographers (and to avoid wind).

His visits to family members in northern California and the Rocky Mountain states were often timed to correspond with native plant society hikes, and he expanded his society memberships to include the California and Utah native plant societies in addition to NPSO.

In 2004, he put his computer skills to use by volunteering to create a website for the Dorothy King Young chapter of CNPS (Mendocino County) and continued to serve as their webmaster until his death. He served as the NPSO webmaster for six years (2006-2012) and set up and moderated the NPSO Discussion List. He posted many, many of his flower photographs on the CalPhotos website, and later in the NPSO Photogallery, which he set up and managed. His personal botanical websites were creative, whimsical, and artistic: http://mitella.org/ and http://botanicals.mymesis.com/photos/main.php. It's worth checking them out!

Starting with one client in Ashland, Norm developed a far-ranging house and pet sitting service that allowed him to botanize and photograph in other areas of Oregon. His reliability, patience, sensitivity and true love of animals resulted in a great demand for his services, and sometimes he was booked a year in advance.

For seven years Norm lived in a rustic cabin in Takilma in the Illinois Valley, surrounded by Douglas fir, madrone, ponderosa pine and white oak. It had an outhouse for a bathroom and no running water, and he loved it. Maybe his longevity there had something to do with the fact that about half the time he could indulge in all the modern amenities in someone else's house! During his time in the Illinois Valley, he acquired extensive knowledge of the location of the many special plants that grow there and shared his knowledge with other plant lovers by leading multiple NPSO field trips. His final residence was in Medford, where he shared a house with the owners.

Prior to moving to the Rogue Valley, Norm lived in the San Francisco Bay area where he taught school. He loved teaching his third graders! He claimed to have been the first person to bring a computer into the classroom there, most probably one that he put together from a kit. He taught himself to sail and spent lots of time sailing in San Francisco Bay. He loved skiing, so when he retired from teaching, he moved to the Lake Tahoe area of California. His interest in computers (again, self-taught) enabled him to set up a consulting business there. And, as ever, he continued to photograph nature.

As a youngster, he was confined for a full year in an iron lung, after contracting polio at the age of ten. He was one of the few to survive this experience and come out relatively unscathed. His brother recalls that it was during this time that he began excelling in school, and perhaps it was during this confinement that he developed his incredible focus and ability to teach himself anything.

Norm loved to cook and eat good food and drink good wine. He was always a welcome guest at dinner parties, especially because he was an attentive, sympathetic and non-judgmental listener. He was a very private person; his way was to learn about others rather than talk about himself. But he was very open to answering questions about himself if asked. He had a great sense of humor and a love of the English language which he put to use frequently; there were those witty jabs with just a touch of sarcasm that always brought a twinkle to his eye, and e-mail exchanges with him could escalate into a game of punsmanship, each pun engendering another over many messages.

Norm was a very special person who has left behind not only the extensive family to whom he was very attached, but also the many friends that he made during his eleven years in Oregon and those previous. His memory lives on in our hearts, and his many exquisite photos populate a number of web pages.

His artistic sense is on display in his wildflower photography and in the composition, arrangement and design of his websites. Norm chose to use his time here on earth doing the things he truly loved. He was a man of peace: gentle, patient, and generous with his time. He walked in beauty.

A memorial fund has been set up through the Oregon Flora Project (http://www.oregonflora.org/) to incorporate Norm Jensen's photographic record of native plants (over 20,000 images) into a lasting archive for use by the botanic community and as a historic record in documenting the Oregon flora. Donation checks may be sent to Agricultural Research Foundation, 100 Strand Ag Hall, Oregon State University, Corvallis OR 97331-4067. In the memo column, please write #4482 Oregon Flora Project, In Memory of (IMO): Norm Jensen.

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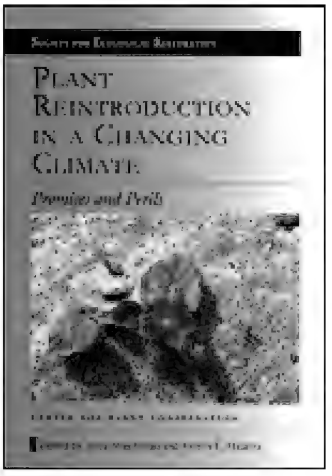

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The "MR" just quoted is an acronym for "managed relocation," a powerful subtext of this book. It is an emerging paradigm that hides under the presumed attention to climate change of the book's title. In all the discussions, after affirming climate change is important, there is no clear offering on how to incorporate climate change predictions into plant reintroduction models. While almost every chapter makes reference to MR, Chapter 13 tackles the subject head on. Managed relocation is a hot topic because its application is controversial. Attention to the idea in the conservation community is recent. The publication record begins in 2005 with a definition of the phrase "assisted migration," changed eventually to "managed relocation" to avoid confusion with animal migration. Managed relocation is exactly the same as reintroduction but with the introduction sites being outside the historical range of the species. The further outside the historical range, the more uneasy skeptical conservation biologists are. Those who are flatly opposed to MR call it "planned invasion." There is a spectrum of conservation biologists whose willingness to consider MR ranges from modest to those who advocate constructing new ecological communities. The arguments make for interesting reading. Most opposition involves fears that relocation could go awry, introducing a potentially aggressive invasive and its microbial associates—also potentially aggressive, detrimental invasives. There are few data to support this apprehension, but it is clearly a strong force to contend with in rare species conservation circles.

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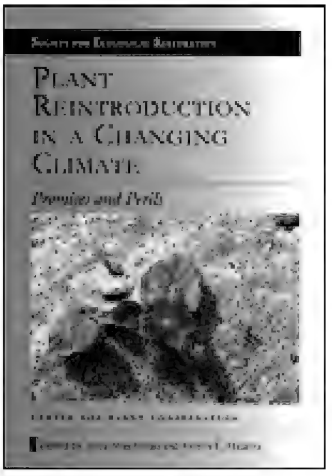

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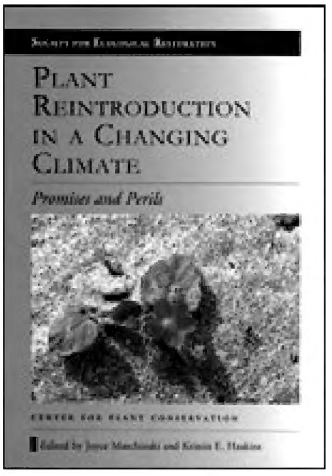

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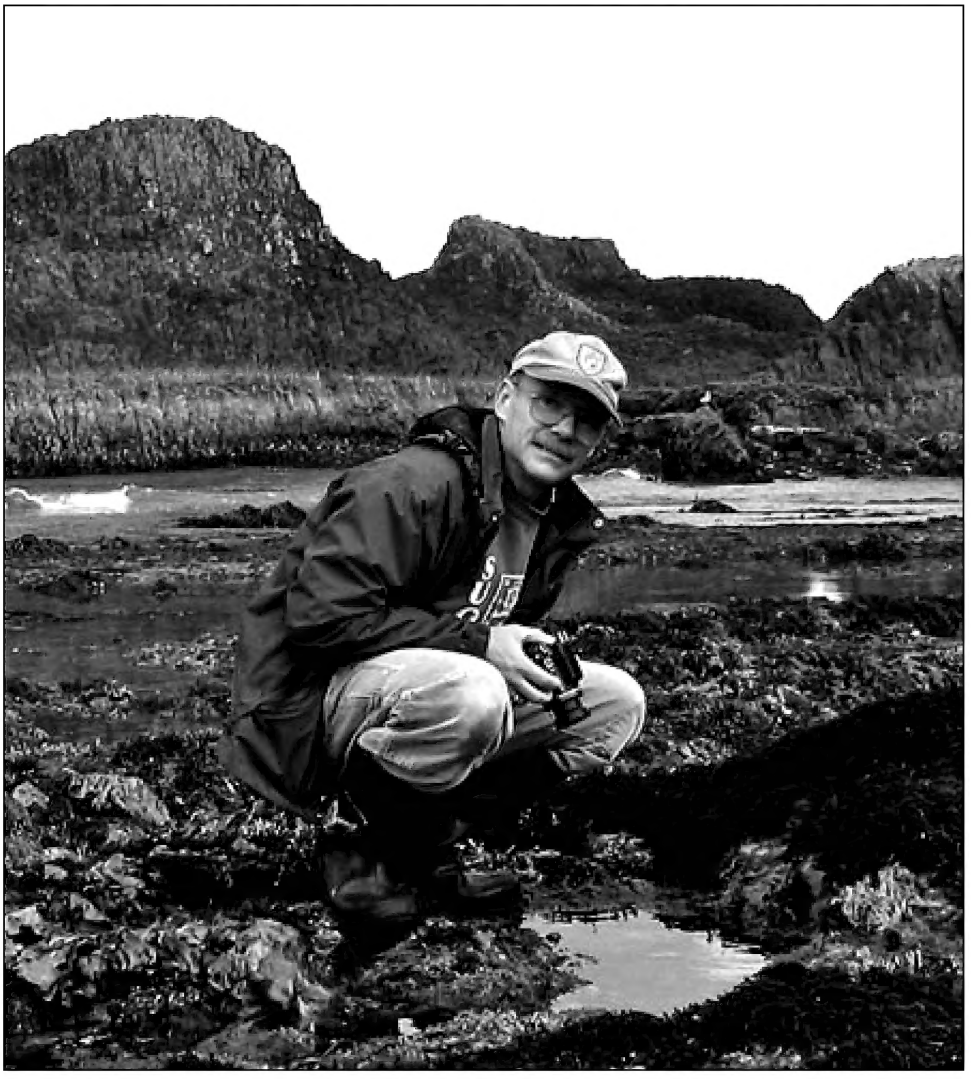
-David Wagner, Emerald Chapter.

Dan Luoma

As an active member who has dedicated his skills and talents to the Native Plant Society of Oregon for over twenty-five years, Dan Luoma has rotated through a number of board positions during that time. He joined our Society in 1982 when Esther McEvoy was getting people together to form the Corvallis Chapter. Dan served as the Corvallis Chapter president from 1983 to 1985 and has served as the chapter's treasurer for many years. At the state level, he served as president for two years (1987 to 1989), immediate past president for two years, vice president for six years, director-at-large for nine years, and has been chair of the field research grants committee and the budget committee for twenty-five years. Anyone who has served on the State Board in recent memory is more than likely to attest that Dan is the go-to person at board meetings for questions regarding NPSO policies, by-laws, finances, history, past stands taken on conservation issues happening around the state, field research grants, and all other matters, large or small. Because of his long association with NPSO, Dan offers a broad, seasoned perspective with a historical context. More often than not, the State Board turns to Dan for sound advice on how to proceed on issues. Working behind the scenes, Dan also displays a winsome talent for recruiting new board members (no easy task) through cajolery and a smile.



Fascinated by the complexity of life in tide pools, Dan Luoma photographs a nudibranch (*Hermissenda crassicornus*) at Seal Rock. Photo by Joyce Eberhart.

Dan grew up in Roseburg where he learned about natural history by roaming nearby hillsides: the family home was on the edge of the town with easy access to woodlands and meadows. It helped that he was, fortunately, not very sensitive to poison oak. His mother, who led hikes for Cub Scouts and Blue Birds, knew some of the common wildflowers. She also took Dan and his sister to some of the earliest wildflower shows in Glide. Dan was interested in plants and fungi from an early age and, in high school, developed an interest in archeology sparked by his participation in summer programs at OMSI's Camp Hancock. In 1975, Dan purchased a Nikon camera and began taking photos of plants. Besides his mother, Dan credits botanists Freeman Rowe, Dave Wagner, Carl Johannessen, Bob Frenkel, Ken Chambers, and John Miller with inspiring his interest in plants. In 1979, Larry Scofield (Salem District Botanist) introduced Dan to NPSO when he worked as a botanist for the Bureau of Land Management (BLM). Rhoda Love and Frank Lang mentored Dan on the board of NPSO, and Jean Siddall and Julie Kierstead taught him the formalities of rare and endangered plant programs.

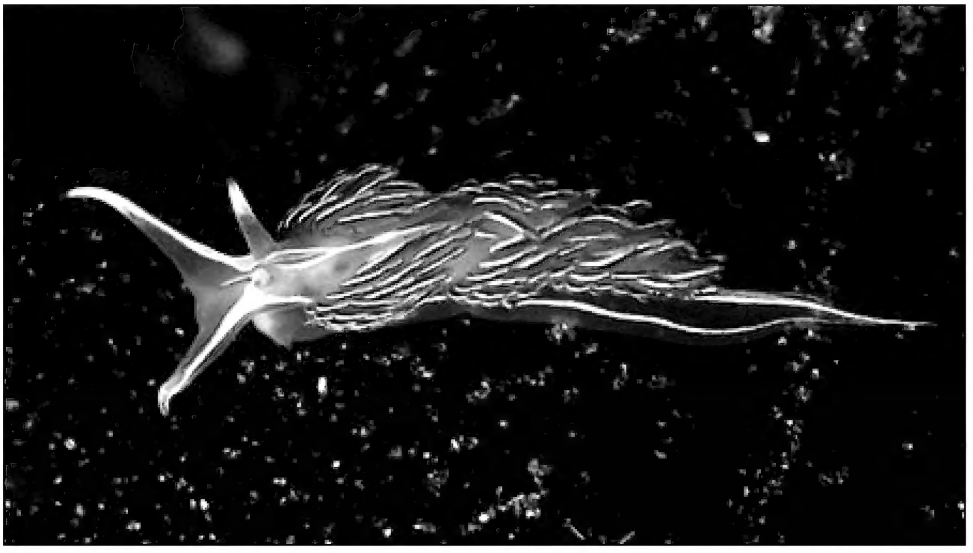
During the academic year of 1975-76 Dan took biology classes from Freeman Rowe at Lane Community College. This launched a more serious study of fungi and vascular plants and in 1978 Dan completed a BS in physical geography and environmental studies at the University of Oregon. Dan was working as a botanist for the BLM in the late 1970s when Freeman Rowe recruited him to help at the Glide wildflower show where he met members of the Limpy Rock botanical committee: Jeanne Moore, Yvonne Knouse, Alice Parker, and Mary Powell. This introduction to the special botanical features of the Limpy Rock area led Dan to study the plant communities in Limpy

Rock Research Natural Area (RNA). Of special interest were non-green plants including snow plant, Indian-pipe, pinesap, fringed pinesap, and gnome plant, all members of the Monotropoideae (achlorophyllous, mycotrophic plants in the Ericaceae). The fact that these plants derive their energy from an underground network of mycorrhizal fungi that are in symbiosis with the fine roots of trees allowed Dan to combine his interests in vascular plants and fungi for his MS thesis in ecological plant geography with a minor in botany (OSU, 1987).

Mycologists Freeman Rowe, Jim Trappe, Bill Dennison, and Steve Miller inspired Dan's keen interest in fungi. Dan learned about hypogeous (belowground fruiting) mushrooms (truffles) in Freeman Rowe's class and from a talk by research mycologist Jim Trappe at a conference in 1977. Three years later, Dan collected his first truffle with Jim. Larry Scofield had set up a BLM study area for fringed pinesap (*Pleuricospora fimbriolata*), and invited Jim to visit the area. Of course, Jim asked the mycologists to hunt for truffles and Dan found a big (and stinky) fruiting body of *Gautieria monticola*. Years later, researchers at UC Berkeley discovered that *Gautieria monticola* is the trophic host for fringed pinesap that, lacking chlorophyll, cannot produce its own carbohydrates. In 1984, Dan started researching truffles as part of his dissertation project at the H. J. Andrews Experimental Forest. Dan went on to complete his PhD at OSU in 1988 in ecological plant geography with a minor in botany. His dissertation was on the quantification of truffle production in relation to forest structure, community type, successional development, and truffle species phenology.

From 1989 to 1997, Dan was a Research Associate in the Department of Forest Science at OSU. Since 1997, he has been an Assistant Professor and senior researcher in the Departments of Forest Science and Forest Ecosystems and Society at OSU. His research focuses on ectomycorrhizal fungus species diversity and fruiting body production in managed and unmanaged forests of the Pacific Northwest. He pioneered experimental designs that evaluate the economic potential of sites for producing commercially harvested edible forest mushrooms, especially Oregon's native truffles of culinary interest. Dan has been a member of the North American Truffling Society since 1980, serving for a time as its vice president. In 2004, Dan was selected as a Distinguished Alumnus by Lane Community College for, in part, his contributions to the Mount Pisgah Wildflower Show, the Mount Pisgah Mushroom Show, and the Glide Wildflower Show.

Along with his professional study of fungi, Dan's botanical interests include native plants in natural habitats, perennial plant gardening with native and non-native plants, and visiting botanical gardens. Dan and his wife, Joyce Eberhart, like to botanize when they travel and bring back photos for presentations that are both informative and entertaining for NPSO chapters. Together, Joyce and Dan have given programs from their botanical experiences in California deserts, Norway, Spain, and Switzerland; however, they are convinced that botanical experiences here in Oregon and the Northwest are among the best in the world, the spectacular wildflower display of Iron Mountain and Cone Peak being only one example. Dan has gotten the greatest satisfaction in life, however, from watching his children successfully navigate the challenges of youth to become independent young adults.



Hermissenda crassicornus. Photo by Dan Luoma.

Asked about his vision for NPSO's future, Dan replied that he would like to see the inactive chapters (High Desert, Blue Mountains, Klamath Basin) revitalized and has offered to help local folks take the steps necessary to make it happen. Dan would also like to continue working on improving membership retention throughout the state. About NPSO, Dan affirms: "I became active in NPSO because I really like the members and our collective commitment to the pursuit of the 'enjoyment, conservation, and study of Oregon's native plants and habitats.' It is a great organization and it fills a niche for a plant-centric group that operates on a personal scale." It's apparent to all who know and have worked with him that Dan Luoma cares deeply about NPSO and is committed to seeing it thrive

-David Lebo, Portland Chapter.

NOTICE TO CONTRIBUTORS

Members of the Native Plant Society of Oregon and others are invited to submit articles, book reviews, artwork, and photographs for publication in *Kalmiopsis*. All materials submitted should pertain to Oregon's native vegetation and flora. Acceptance will be based on suitability (articles dealing with formal nomenclatural proposals or of a highly technical nature are not acceptable). *Kalmiopsis* publishes two series articles: *Plant of the Year*, and *Oregon Plants, Oregon Places*. We also publish articles about botanical history and features related to native plants or plant communities in Oregon.

Please consider that the readers of *Kalmiopsis* are people with varied educational backgrounds and all articles must be comprehensible to a broad, but relatively well educated, audience. The goals of *Kalmiopsis* are to disseminate correct information about and generate interest in native plants, thus each article is reviewed by the editorial board and selected technical reviewers before publication.

Contributions of artwork and photographs without accompanying manuscripts are welcome; color submissions must be suitable for publication in grayscale. Contact the *Kalmiopsis* editor to request a copy of Instructions to Authors, or to inquire about the suitability of an idea for an article.

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MEMBERSHIP

Membership in the Native Plant Society of Oregon is open to all.
Membership applications, renewals, and changes of address (include old address and zip code) should be sent to the NPSO Membership Chair, Clayton Gautier, 3927 Shasta View St., Eugene OR 97405-4442.
Student $12; Regular $25; Family $35; Sustaining $60; Patron $125; Life Member $500;
Subscription Only (Bulletin and Kalmiopsis) $25

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